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Making Transportation Accessible

A Canadian Planning Guide

Transportation

Development

Centre

Canada

Making Transportation Accessible
A Canadian Planning Guide

Transportation Development Centre
Safety and Security
Transport Canada

May 1998

The use of an accessible transportation service or product as an example or an exhibit does not constitute an endorsement of that service or product by Transport Canada

Cat. No.: T48-32/1998E
ISBN: 0-660-17452-9
TP 13114E

Ce manuel est également disponible en français : «Accessibilité des transports au Canada – Manuel de planification», TP3114F.

Preface

This book is intended as a record of Canadian experience and best practice in the art and science of making transportation more accessible for all travellers, particularly those who are disabled or elderly. It provides a history of the development of accessible transportation in Canada, yet it is not a textbook – it is application-oriented.

Making Transportation Accessible: A Canadian Planning Guide is designed to assist planners, operators, carriers, designers, and manufacturers in the development of accessible transportation systems, products, and services.

This undertaking would not have been possible without the diligence and perseverance of the Editorial Committee, the Consultant Team, the TDC Project Team, and the many other contributors, listed on the following pages.

The ***Guide*** marks the achievement of over a quarter-century of vision, commitment, and hard work by dedicated people in the transportation and disabled communities. We would like to thank all those whose tireless efforts have helped to make Canada a leader in accessible transportation systems.

Ling Suen
Chief, Research Analysis and Special Programs
Transport Canada, Transportation Development Centre

Trevor Smith
Senior Research Officer
Transport Canada, Transportation Development Centre

Acknowledgements

Editorial Committee

S. Ling Suen	Transportation Development Centre (Chairperson)
Laurie Beachell	Council of Canadians with Disabilities
David Long	Canadian Bus Association
Bruce Chown	BC Transit
Tom Yang	BC Transit
Rannie MacDonald	VIA Rail Canada Inc.
Michel Trudel	Ministère des Transports, Gouvernement du Québec
Pat Pellegrino	Canadian Urban Transit Association
Michael Skrzypczak	Marine Atlantic Inc.
Dave Leonhardt	Canadian Automobile Association
Chris Bellchamber	One Voice Seniors Network (Canada) Inc.
Colin Cantlie	Canadian Hard of Hearing Association
Linda Legault	Air Canada Centre
Chantal Stanyer	Air Canada Centre
Eric Boyd	Canadian Paraplegic Association
Howard Goldberg	Air Transport Association of Canada
Bill Menzies	Transportation Association of Canada

Consultant Team

W. G. (Wally) Atkinson	MANOP Services Ltd. (Manuscript Editor)
Ann Finlay	MANOP Services Ltd.
J. A. Schmidt	MANOP Services Ltd.
Audrey Atkinson	MANOP Services Ltd.
U. Rutenberg	Rutenberg Design Inc.
A.-M. Rutenberg	Rutenberg Design Inc.
T. E. (Tom) Geehan	TransVision Consultants Ltd.
Ulrika Wallersteiner	Ergo Systems Ltd.
Anne-Kristina Arnold	Ergo Systems Ltd.
Angela S. Iannuzziello	ENTRA Consultants Inc.
Charles Fitzsimmons	Techknowledge Consulting

Transport Canada - Transportation Development Centre (TDC) Project Team

S. Ling Suen	Chief, Research Analysis and Special Programs
Trevor N. Smith	Senior Research Officer
Barbara A. Smith	Project Officer, Special Needs
Rémi Joly	Senior Ergonomist
D'Arcy O'Connell	Senior Program Manager
Roy S. Nishizaki	Senior Development Officer, Current Technology

Other Contributors

Joan MacDonald	Canadian Transportation Agency
Carmen Hall	Transport Canada
Catherine Taylor	Alberta Transportation and Utilities
Margaret Dushenski	Edmonton Transit
Kent S. Cook	TRANS-OP Consulting Services
Dan Francey	GO Transit
John Hubbell	Calgary Transit
Norm McLeod	Transhelp (Mississauga)
Pat Larkin	Para Transpo (Ottawa)
Dennis Fletcher	ENTRA Consultants Inc.
Donald Hunt	Bombardier Inc.
Mary Simms Jacques	Prévost Car Inc.
Patrick Grenier	Nova BUS Corporation
Ron Leier	Alberta Hotels Association

About This Guide

Target Audiences

This guide was developed as a reference for transportation planners and designers responsible for policy, as well as for those with technical responsibilities. It will also be useful to educators and students in the fields of planning and design.

While not primarily intended for consumers, it could be useful to a more general audience. Technical terms are defined on page ix and x or simplified in the text, and explanations are sufficient to allow an average reader to understand the subject matter.

Scope

The guide includes:

- planning and design guidelines for accessible transport, based on a synthesis of two decades of research and development, and operating practice;
- a discussion of all modes of transport and their related systems, services, and technologies;
- a planning data base on the needs of seniors and travellers with mobility, sensory, or intellectual disabilities;
- a discussion of accessibility issues common to all modes, i.e., trip planning, terminal access, parking, communications, safety, training, and research;
- a discussion of accessibility issues, standards, regulations, technology, and planning guidelines unique to each mode.

Authors and Sources of Data

The guide was developed by a multidisciplinary team of consultant specialists working under the guidance of TDC staff, MANOP Services Ltd., and the members of the Editorial Committee.

The final product represents the findings from more than 300 selected research, development, and demonstration projects. Many of these projects were sponsored by TDC, while others were sponsored by provincial and municipal agencies or national transportation associations. Most of the TDC projects were carried out in cooperation with provincial and municipal agencies. Where gaps were found in Canadian planning and design guidelines, international sources were consulted and the best judgment of the project specialists was solicited.

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Structure

The figure above provides a “road map” to the contents of the guide. The information is deliberately organized in the sequence in which decisions are made by persons planning for their travel. This allows planners and designers to visualize the needs of travellers with disabilities – from trip origin to destination.

Planning guidelines common to all transportation modes are presented in Chapters 2-8. Accessibility issues and the technology for each mode are discussed in Chapters 9-16. Chapter 17 provides an overview of the accessibility requirements for service and checklists for modal integration.

To avoid undue duplication of content, many topics are discussed in detail in one chapter only. Readers interested in specific topics should consult the Index.

Terms and Language

The following terms are used throughout the guide:

- **Traveller:** An all-inclusive term for persons who are making trips, whatever the mode used.
- **Customer:** The terms "customer" and "potential customer" are used because they are more inclusive than "passenger" or "rider". (A person cannot become a "passenger" until he or she has gained access to a transportation carrier.) "Customer" is synonymous with "consumer".
- **Passenger:** A customer on board a transportation vehicle. (A person is not a passenger while in a transportation terminal.)
- **Accessible:** Except in the context of air transport, the term "accessible" means that most types of wheelchairs can be accommodated, and that customers can remain in their own wheelchairs while travelling. An aircraft is considered accessible if one of its washrooms can be used with an on-board wheelchair. The term "partially accessible" means that most persons with a physical, mental, or medical disability can be accommodated. Purpose-built buses, railcars, and taxis are accessible.
- **Paratransit/Parallel Transit:** Transit systems that use small vehicles to operate in a demand-responsive mode are commonly termed "paratransit" systems. This term developed from "parallel transit", used because these systems usually operate in parallel with conventional transit services.
- **Carrier Terminology:** Transportation carriers frequently use terms of historical significance in their customer communications. For example, a horse-powered system might have been named *Pacific Stage Lines*. When the company began to use motor-powered vehicles, the name might be changed to *Pacific Coach Lines* or *Pacific Bus Lines*. Similar examples can be found in all modes. Some transit systems, for example, were still being called *street railways* long after they ceased to operate any rail vehicles.

For clarity, and to facilitate translation, the following terms are used consistently in this guide:

- *Automobile* (not "auto" or "car")
- *Taxi* (instead of "taxicab" and "cab")
- *Bus* (instead of "motor coach")
- *Railcar* (not "coach" or "car")
- *Aircraft* (not "airplane" or "plane")
- *Vessel* (not "ship" or "craft")
- *Terminal* (not "station", "depot", or "dock")

Standard terminology has been used for the physical process of gaining access to transportation systems. Thus, one can "enter" a terminal, but one "boards" a vehicle. The following table presents some of the terminology used by transportation planners. Other terms used in a particular mode or technology are defined within the relevant chapter for that mode or technology.

Common terms used by transportation planners

	Road Transport	Rail Transport	Air Transport	Marine Transport
to enter	board	board	board, enplane	embark
to exit	deboard, alight	deboard, alight	deplane, disembark	disembark
boarding point	island	platform	gate	dock
to arrive	arrive	arrive	arrive	disembark
to leave	depart	depart	depart	embark
vehicle	bus, van, automobile	railcar	aircraft	vessel
reception staff	ticket agent	ticket agent	passenger agent	ticket clerk
on-board staff	driver/operator	train personnel	air crew	steward(ess)
storage	garage, depot	shop	hangar	storage

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MODAL INTEGRATION

The structure diagram above shows how the contents of the guide are organized.

1 Introduction

According to Statistics Canada, 2.2 million Canadian adults had transportation disabilities in 1995. These Canadians, whose disabilities variously affect their ability to travel, represented 9.9 percent of the overall adult population. It is anticipated that by the year 2020, these numbers will increase by 80 percent to 3.9 million, or 12.3 percent of the adult population. Thus, measures to improve access to transportation systems will increasingly be required in Canada, as in other countries with an aging population (Suen and Turnbull, 1995; Turnbull and McKenzie, 1995).

This guide contains an overview of the current status of accessible passenger transportation in Canada and provides guidelines for persons responsible for planning and delivering accessibility in transportation systems and services. The guide is multi-modal in scope to facilitate the transfer of experience from one mode to another. The inclusion of national, regional, and local experience may also facilitate technology transfers within Canada and to other countries.

While the guide was developed for transportation planners and designers in the broad context (including those responsible for policy planning, and those with technical responsibilities), it will also be useful to educators and students in the fields of planning and design.

This first edition of the guide is timely for several reasons:

- It marks the successful completion of the five-year National Strategy for the Integration of Persons with Disabilities announced by the Prime Minister of Canada in September 1991.
- It describes a major leap forward in the accessibility of Canadian air, bus, rail, and marine transportation systems through the implementation of new policies, technologies, and procedures.
- It summarizes the lessons learned from the most significant research, development, and demonstration projects undertaken by federal, provincial, and municipal agencies since 1981, the International Year of the Disabled Person.
- It identifies needs and opportunities for further research and development.
- It provides state-of-the-art guidelines for making all passenger transportation systems more user-friendly.

The process of making transportation systems more user-friendly has evolved through the following stages:

- A growing awareness of obstacles and barriers to travel by persons with physical disabilities (prior to 1981).
- A better understanding of the needs of seniors and those with less visible disabilities (since 1981).

- The development of new service policies, new technology, and new methods of upgrading transportation facilities; and quantification of the numbers of persons with disabilities (1984-90).
- The implementation of new policies, guidelines, and technology to improve access to transportation systems (1990 to present).
- A growing awareness that the benefits of more user-friendly transportation systems accrue to most if not all travellers.

1.1 Canadian Milestones in Accessibility

A review of the improvements made to accessibility during the last two decades reveals some unique achievements and experiences. Table 1.1 presents some of the milestones on the "road to accessibility".

Many other milestone events, including transportation conferences, workshops, inquiries, public hearings, and court challenges under human rights legislation, contributed to the development of accessibility policies and procedures. Examples of these events include public hearings in Ottawa in 1979 on problems with transportation under federal jurisdiction (Canadian Transport Commission, 1980); CTC-ordered accessibility to VIA Rail trains in July 1980 as a result of a formal complaint by Clariss Kelly in 1980 (Baker, 1984); and a judgment against Air Canada in a challenge by Ruth Adelia in 1985 (CTC, 1986). Achievements that occurred over a period of time rather than on a specific date are discussed throughout the guide.

The following are worth noting for their unique contributions:

- the province of Quebec, for unique experience with taxi regulation and driver training, and contracted services for seniors and persons with disabilities in both rural and urban areas (Section 9.2);
- The city of Vancouver, for the first and largest accessible taxi fleet in Canada to date (Section 9.3.2);
- The province of Ontario, for the concept and implementation of a family of accessible transit services (Section 10.3);
- BC Transit, for the first fully integrated accessible rail, bus, paratransit, and marine ferry system in Canada (Section 17.3);
- Ontario's GO Transit, for the first fully accessible commuter rail system in Canada (Section 14.4);
- VIA Rail Canada, for developing the specifications that led to the manufacture of the first accessible LRC (light, rapid, comfortable) passenger railcars (Section 14.3);
- Ontario Bus Industries Ltd., New Flyer Industries Ltd., and Overland Custom Coach Inc., for the first low-floor buses in Canada (Chapter 10).

Table 1.1 Canadian milestones in accessible transportation

1970	Transport Canada established the Transportation Development Agency (TDA) in Montreal to undertake R&D projects. The Agency later became the Transportation Development Centre (TDC). TDA initiated research into dial-a-bus technology, which led to applications for seniors and persons with disabilities.
1972	TDA initiated research into transportation accessibility. Jacques and Jean-Marc Forest established Les Minibus Forest Inc., Canada's first parallel transit service, in Montreal.
1976	The Canadian Human Rights Act made "disability" a prohibited "ground of discrimination".
1979	Transport Canada established a Transportation for Disabled Persons Directorate and an Advisory Committee on the Transportation of the Handicapped (ACTH).
November 1979	The British Columbia Urban Transit Authority (now BC Transit) initiated lift-equipped transit buses on one route in Victoria – the first attempt in Canada at providing accessible bus transit service.
February 1981	The *Obstacles* report of the Special Parliamentary Committee on the Disabled and the Handicapped recommended that major transportation terminals under federal jurisdiction be made "reasonably accessible" and that a national accessibility policy be developed in consultation with persons with disabilities (Canada, 1981).
1982	The Canadian Charter of Rights and Freedoms clarified that discrimination based on a physical or mental disability is prohibited under law.
1983	The Ministry of State for Economic and Regional Development augmented funding for accessible transportation.
May 1983/ January 1984	Transport Canada released a policy on accessible transportation for persons with disabilities.
1984	Transport Canada initiated two air accessibility studies, one concerning access to aircraft, the other addressing accessibility within air terminals. Ontario Bus Industries began production of the Orion II, the first purpose-built, low-floor small bus. The Canadian Standards Association (CSA) published the first edition of CSA-D409, a National Standard of Canada for Motor Vehicles for the Transportation of Persons with Physical Disabilities.

Table 1.1 Canadian milestones in accessible transportation *(cont'd)*

1985	Transport Canada established the Transportation of Disabled Persons Implementation Committee (TDPIC).
1986	Transport Canada established the Transportation of Disabled Persons Program (TDPP). Accessible SkyTrain went into service in Vancouver.
1988	Transport Canada and the Federation of Canadian Municipalities introduced the Five Star Award program to recognize outstanding achievements in accessibility by Canadian municipalities. The Ministry of Transportation of Ontario (MTO) introduced a capital subsidy for accessible taxis.
May 1988	The province of Alberta established the Premier's Council on the Status of Persons with Disabilities.
July 1988	The National Transportation Act, 1987, was amended to give the National Transportation Agency (NTA) power to make regulations and to resolve complaints with respect to Canada's federally regulated transportation network.
1989	The Toronto Transit Commission launched the Lawrence Manor 400, Canada's first Community Bus application, an accessible fixed-route service.
April 1989	BC Transit adopted a policy of accessibility on fixed-route transit service.
1990	New Flyer Industries Limited of Winnipeg, Manitoba, displayed the first full-sized, low-floor urban bus manufactured in Canada.
June 1990	Overland Custom Coach Inc. unveiled the ELF, its mid-sized low-floor bus.
September 1990	The Vancouver Regional Transit System deployed 86 lift-equipped buses on 22 routes.
September 1991	The Prime Minister announced a new five-year National Strategy for the Integration of Persons with Disabilities.
October 1991	Transport Canada released *Access for All*, updating the 1983 policy on accessible transportation.
May 1992	First seven low-floor buses went into service in Victoria.
June 1992	The Ontario Minister of Transportation announced a policy of fully integrated accessible transit services.
November 1992	Greyhound Bus Lines inaugurated a fully accessible bus run between Calgary and Edmonton, Alberta.

Table 1.1 Canadian milestones in accessible transportation *(cont'd)*

July 1993	The Ontario Minister of Transportation announced a policy of acquiring low-floor buses.
January 1994	New Air Transport Regulations required airlines to provide "certain services and information to travellers with disabilities" on large aircraft.
June 1995	Ontario's GO Transit commuter rail system inaugurated accessible rail services at several stations.
July 1995	TDC established the TransAccess™ Information Base on disability and transportation.
November 1995	BC Transit inaugurated the WestCoast Express, an accessible commuter rail system between Mission and Vancouver, B.C.
1996	The new Canada Transportation Act, 1996, changed NTA to the Canadian Transportation Agency (CTA), which retained the existing powers to regulate the carriers and to resolve complaints.

1.2 Market Needs and Constraints

This guide is designed to provide guidelines for transportation planners and designers to ensure that people of all ability levels can travel safely and more easily. This approach is consistent with the marketing objectives of transportation carriers to provide a user-friendly environment to all customers.

Since the cost of making transportation systems easier to use affects all customers, it makes sense to address the needs of a broad spectrum of travellers, including those with physical disabilities; those who experience difficulty understanding signs, communications systems, and the rules and regulations pertaining to transportation systems; and many others who may resent the long walks and numerous level changes they encounter in major transportation terminals.

Table 1.2 compares disability characteristics within the general population with the characteristics of persons with transportation disabilities. These data were derived from the TransAccess™ Information Base developed by Goss Gilroy Inc. under a TDC contract (Turnbull and McKenzie, 1995), and are based on the 1991 Health and Activity Limitation Survey (HALS) undertaken by Statistics Canada. The 1991 data have been projected to 1995 to provide the current TransAccess™ Information Base. The data reveal two significant factors:

- The incidence of multiple disabilities is greater among those who experience difficulty using transportation.

- Persons with hearing impairments have a lower incidence of inability to use or difficulty in using transportation systems compared with persons with other disabilities.

Table 1.2 Disability characteristics of persons with disabilities and persons with transportation disabilities (1995)

Type of Disability	Persons with Disabilities (000s)	Person with Transportation Disabilities (000s)	Incidence of Transportation Disability (%)
Mobility	2,271	1,646	72
Agility	2,067	1,492	72
Seeing	558	414	74
Hearing	1,171	681	58
Speaking	257	201	78
Other	1,137	857	75
Total Persons	3,813	2,193	58
Total Disabilities	7,461	5,291	70
Disabilities per Person	1.9	2.4	–

(TransAccess™ Information Base)

The following statistics characterize the group of persons with disabilities who use personal vehicles and local transit services for short trips:

- With respect to local travel, 596,000 persons with disabilities (15.6 percent of the 3.8 million persons with disabilities) stated that they have difficulty taking short trips. The majority, 3 million persons with disabilities (78.3 percent), did not have any difficulty. (The remaining 6.1 percent were unstated responses.)
- Of the 596,000 persons with disabilities who have difficulties taking short trips, 243,000 stated that they consider themselves restricted to their residence. This represents 6.4 percent of the 3.8 million persons with disabilities. The primary reason given by 60.6 percent of the 243,000 respondents for considering themselves restricted to their residence was that their condition or health problem was aggravated when they went out.

- Because of their condition or health problems, 513,000 persons with disabilities need an attendant or companion to accompany them on short trips.
- An estimated 1.98 million persons with disabilities have specialized transit service available in their community; 690,000 do not; and 668,000 do not know whether a service is available or not.

These statistics characterize the group of persons with disabilities who make long-distance trips by all modes:

- Of persons with disabilities, 2.9 million (76.2 percent) are able to make long-distance trips, while their condition or health problems prevent 676,000 (17.7 percent) from taking such trips. (The remaining 6.1 percent were unstated responses.)
- Several difficulties prevent long-distance travel: for example, the flight or ride aggravates their condition; problems may occur with seating on board, with transporting mobility aids, and with boarding and deboarding; travel is costly.
- Because of their condition or health problems, 537,000 persons with disabilities require an attendant or companion on long-distance travels.
- Because of their condition or health problems, 89,000 persons with disabilities require specialized transportation services or facilities on long-distance trips.
- Among persons with disabilities able to travel long distances, 1.5 million state that they can easily obtain information on specialized transportation services or facilities for long-distance trips; 500,000 state that they could not easily obtain such information; and 900,000 did not know.

1.2.1 The Concept of "Reasonable Accommodation"

Prior to or in the absence of regulation, public carriers have been expected to apply the concept of "reasonable accommodation". This means taking reasonable steps to assist persons with disabilities and dysfunctions to participate as fully as possible in every aspect of society. In Canada, the economic burden of providing reasonable accommodation must be shared by all travellers. For transportation systems operated by government agencies, the burden may be wholly or partly subsidized by taxpayers. For private carriers, additional costs of accommodation must be shared among all of their customers.

If economy and safety issues could be ignored, it would be possible to accommodate almost every customer. The reality is different – transportation systems are expensive to design, to construct, to modify, and to operate. In addition, a long lead time is often required before new technology can be implemented.

1.2.2 Efficiency and Effectiveness

When reviewing accessibility issues, it is important to remember that transportation systems are designed to move people from one place to another safely, efficiently, and economically.

In addition, carriers need to provide access with dignity and to make the trip a pleasant experience so that a customer will reuse a particular mode.

1.2.3 Scope of Accessibility Needs

The scope of consumer needs includes the ability to make pedestrian trips (see Chapter 3); to travel to transportation terminals by taxi, bus, or personal automobile; and to gain access to terminal facilities and the vehicles used by the carriers.

External terminal accessibility includes

- fixed signs (directions, travel information, regulations)
- reserved accessible parking areas
- accessible pathways
- accessible thresholds
- weather protection

Internal terminal accessibility includes

- communications systems
- check-in counters
- washroom facilities
- elevators
- waiting areas and seating
- food services and shopping facilities
- baggage-handling facilities

Vehicle accessibility includes

- communications systems
- boarding and deboarding procedures
- emergency procedures
- support equipment on board
- washrooms (if any) on board
- level of assistance on board

Personal mobility includes

- ability to use, store, and transfer mobility aids and equipment
- provision for service animals
- attendant assistance if needed

1.2.4 Current Issues

Relying on Market Forces

Market forces alone may not be enough to deliver universal accessibility because private transportation entrepreneurs tend to respond to the most profitable routes and services first. This tendency is illustrated on a micro scale by the taxi operator who decides to stay home during a heavy snowfall because the potential revenues are small in comparison to the risk of an accident. A similar analysis is made by a venture capitalist who will not fund the modernization of a major transportation terminal unless guaranteed a reasonable rate of return on the investment.

Providers of public transportation services must rank full accessibility among a long list of priorities. For private-sector companies, profitability is the first priority. If a private carrier cannot make a profit, it will not stay in business. Profitability and regulatory constraints (if any) determine which improvements may be feasible and when they can be implemented.

Selecting Appropriate Technology

A major issue is the criteria for selecting a particular transportation technology once its purpose has been determined. Effectiveness and cost have been the criteria typically used in the past. While important, they may be insufficient for selecting technologies for people who need assistance but are unable to obtain it. Also, the criteria do not usually take into account the broad benefits the technologies may have for other people.

As an example, while urban and commuter rail technology is becoming accessible, long-distance intercity rail service is gradually being phased out in Canada. At present, no other intercity transportation mode can match the comfort, convenience, and capacity for growth of the accessible commuter rail systems.

Travelling Independently

The need for and cost of providing a travel attendant for a passenger requiring assistance is often a major barrier to travel. In many cases, improved systems technology and training of disabled travellers to use available facilities could eliminate this need.

The move towards a fully accessible transportation system in Canada must be a joint effort between transportation agencies, transportation providers, and persons with disabilities. Transportation agencies and providers must continue to improve on-board information systems. Travellers with sensory and cognitive disabilities need to have a better understanding of how best to use information systems already in place; for example, by making carrier attendants aware of their specific needs.

Standardization

In Canada at present, there is a tendency for each transportation mode and each operating jurisdiction to develop unique technology. This approach works against the possibility of lower-cost, universal designs that are easily understood by all travellers. For example, the new communication systems being developed to accommodate travellers with special needs at air terminals, such as *Communicaid* and *Translaid* (see Chapter 5, Section 5.2.2), would also be beneficial in bus and rail terminals.

Companies interested in marketing appropriate technologies may need to be encouraged and assisted to do so through public and private sector partnerships. Small private firms often have the capability for developing innovative technologies yet lack the means of identifying and reaching those who could benefit from them. The cost of special market surveys is large and the potential market is perceived as being small. Therefore, a related need is for market research into how technologies designed specifically for persons with disabilities can benefit all travellers.

Harmonization

The goal of harmonization is to coordinate transportation systems and the related tariffs and service policies so that a traveller is able to cross jurisdictional boundaries without stress. Harmonization is particularly important in large metropolitan areas with multiple travel modes and jurisdictions. For example, a Greater Toronto Area Transit Integration Task Force is currently addressing the issue of coordinating transit services in contiguous municipalities. The further extension of the concept of harmonization to the coordination of feeder and line-haul transportation modes is becoming known as the *seamless trip*.

Information Systems

A great variety of technologies for transferring information are available. A common result of this variety is that individuals in similar situations receive different amounts and types of information. Necessary information may not be received, and what is received may not be entirely necessary. This creates confusion for everyone, especially perhaps for persons with sensory and cognitive disabilities. The standardization of information presentation throughout all vehicle systems would greatly assist travellers.

Only with the clearest possible information can an individual traveller's needs, desires, and capabilities be appropriately matched with available technologies. Limited resources can best be allocated by transportation providers with concise and accurate information on the availability of technologies, how they perform, how they may be obtained, and how they may be funded.

Leadership

There is no substitute for enlightened leadership in transportation. Most milestone achievements in accessibility have come about as a result of the willingness of someone in government or industry to cease analysing options and to start implementing change. Advocate agencies know this and therefore continually lobby people in leadership roles. This process does not always result in the best decision, but it allows an organization to move forward.

Research and Development Awareness

Increasingly, the public, researchers, and manufacturers express dissatisfaction with the rate of application of research results. The capabilities and resources to develop technologies that will benefit persons with sensory and cognitive disabilities do exist, but typically they are not made widely available. The rapid pace at which the private sector produces innovations adds to the list of technologies that could have significant benefits. Because very few travellers currently benefit adequately from existing technological capabilities and resources, greater effort is required to transfer, apply, and market existing technology.

1.3 Federal Role in Accessibility

Under the Canadian constitution, responsibility for transportation is divided among the federal, provincial, and territorial governments. The federal government has jurisdiction over interprovincial transportation, which includes air, rail, and marine transportation. Regulation of intercity buses has been delegated to the provinces and territories, which also have responsibility for most interurban road transport and, in conjunction with the municipalities, for urban transportation. Thus, a typical trip across Canada involves travelling through multiple jurisdictions and using multiple transportation modes. Clearly, for accessibility, harmonization between jurisdictions and modes is critical if people with disabilities are to travel with ease and dignity.

In 1980, the first government-wide federal initiative designed to address the needs of people with disabilities involved the creation of the Special Parliamentary Committee on the Disabled and Handicapped. Its report, *Obstacles*, was published in 1981, the International Year of Disabled Persons. The report contained over

130 recommendations calling for action by the federal government. Twelve of the recommendations were of specific concern to the transportation community. As a result of this report, the Canadian Human Rights Act was extended in 1982 to protect persons with disabilities from discrimination in the provision of goods, services, facilities, accommodations, and employment. Later in 1982, the Charter of Rights and Freedoms was enacted, containing an "equality rights" provision prohibiting discrimination on the basis of "mental or physical disability".

1.3.1 Canadian Transportation Agency

Under the National Transportation Act, 1987, the National Transportation Agency (NTA) replaced the Canadian Transport Commission and was given the power to make regulations to eliminate obstacles and to resolve disputes within Canada's federally regulated transportation network. This network includes rail, marine, and air carriers, as well as rail, marine, and air terminal facilities.

On July 1, 1996, the Canadian government promulgated the Canada Transportation Act, 1996. Pursuant to this Act:

- The National Transportation Agency will be continued as the Canadian Transportation Agency (CTA) with the same regulatory powers for accessibility while other areas are deregulated.
- The Railway Act will be consolidated with the Canada Transportation Act.
- Other relevant Acts will be amended or repealed.

1.3.2 Role of Transport Canada

While the role of Transport Canada has been changing with the advent of federal deregulation policies, there has been consistent support for the principles of universal access to Canadian transportation systems. Currently, the Ottawa-based Accessible Transportation Policy and Programs Directorate is involved in coordinating interdepartmental programs, international liaison, strategic planning and development, and technology monitoring. Support for accessibility has been manifested in four major areas:

- policy development
- research and development programs
- funding for special programs
- provision of advice and assistance in developing voluntary standards (CSA, SAE, ISO)

The increased emphasis on accessible transportation in Canada can be traced back to 1972 when R&D began within Transport Canada at the Transportation Development Agency, subsequently renamed the Transportation Development Centre (TDC). Transport Canada provided support for accessible transportation through the funding of R&D and by dealing with the problem of barriers to accessibility in federal terminal facilities.

In 1979, Transport Canada established a Transportation for Disabled Persons Directorate. Subsequently, during the period May 1983 to January 1984, the department formally set out its policy "to ensure the safe, reasonable, and equitable access to transportation modes under federal jurisdiction, and to remove the barriers to travel, both physical and attitudinal, experienced by disabled persons". This policy of removing barriers to travel focused on enabling people with transportation disabilities to travel across Canada. A Transportation for Disabled Persons Implementation Committee (TDPIC) was established in 1985.

In 1986, Transport Canada provided funding under the Transportation of Disabled Persons Program (TDPP). The TDPP objectives were:

> to fund, promote, and coordinate initiatives intended to benefit elderly and disabled persons in improving access to transportation services under federal jurisdiction, as well as to promote the development of a safe and efficient national transportation system while meeting government objectives.

In 1991, the TDPP funding was overlapped by the National Strategy for the Integration of Persons with Disabilities (see Section 1.3.5) and *Access for All, Transport Canada's Policy on Accessible Transportation* was issued.

> Accessible transportation is a right, not a privilege. All Canadians should be able to use Canada's transportation system without impediment. Transport Canada supports fully integrated, barrier-free transportation that accommodates the needs of seniors and persons with disabilities.

These policy initiatives entrenched the principles of consulting with people with disabilities to determine their needs, and integrating these requirements into the design and operation of public transportation systems (Suen and Turnbull, 1995).

The policy outlined a number of basic principles. When travelling, persons with disabilities are entitled to be treated with the same dignity, consistency, and consideration afforded to other travellers, and to receive services customarily available to the general public. It stated that "passengers with disabilities should not be subject to unreasonable terms and conditions of carriage, nor face additional charges or higher fares related to transportation services provided for them".

1.3.3 Transportation Development Centre

The Transportation Development Centre (TDC) is Transport Canada's central R&D organization. Its aim is to improve the safety, efficiency, and accessibility of the Canadian transportation system, while protecting the environment.

Located in Montreal, TDC is a component of the Safety and Security Group of Transport Canada. Its mandate is to enhance the department's technological capability, to promote innovation in transportation, and to address the department's strategic objectives.

TDC is headed by an Executive Director and staffed by a multidisciplinary team of engineers, planners, ergonomists, and economists responsible for formulating and managing projects. A research library and a publications division provide information and communication services.

TDC's accessibility, R&D, and technology-transfer efforts have contributed to a wide variety of improved technologies and systems designed to assist people with disabilities. As a result of R&D, accessibility improvements have been introduced through vehicle conversions, low-floor minibuses, aircraft-boarding devices, visual communication networks, and accessible intercity buses, to name a few.

While TDC's accessibility program benefits primarily people with transportation disabilities, it also fosters:

- the development of a professional community of planners, engineers, and operators, through publishing and networking;
- the continuing development and implementation of equipment and software;
- the development of standards and the improvement of professional and operational practices in the field, both nationally and internationally.

1.3.4 Advisory Committee on Accessible Transportation

The pioneering work by TDC led to the recognition in Transport Canada that consultation and consumer input were needed to help guide their accessible transportation initiatives. In 1979, Transport Canada established the Advisory Committee on Transportation Needs of the Handicapped (ACTH) and, in 1985, set up the Transportation for Disabled Persons Implementation Committee (TDPIC). The committee consisted of representatives from user groups and government. It provided recommendations on R&D activities and the selection, coordination, and evaluation of related programs and projects. This committee was the forerunner to the Minister of Transport's current Advisory Committee on Accessible Transportation (ACAT), a group of national representatives of consumer organizations and transportation service providers.

ACAT plays a key role in advising the Minister of Transport on the concerns and interests of consumers and industry, in developing solutions to problems related to accessible transportation, in changes to the role of CTA, and in monitoring the implementation of initiatives designed to make transportation more accessible.

1.3.5 National Strategy for the Integration of Persons with Disabilities

The TDPP was superseded in 1991 by the five-year National Strategy for the Integration of Persons with Disabilities. This strategy was designed to improve access to employment, training, housing, recreation, communications, and transportation, and to foster public sensitivity and community integration. The Canadian government identified three key goals for this strategy: equal access, economic integration, and effective participation by Canadians with disabilities in the mainstream of national life. Improved accessibility of our national transportation systems for people with transportation disabilities was critical to the achievement of equal access.

Transport Canada was one of ten federal departments involved in this strategy, and had responsibility for a $24.6-million program containing 14 initiatives:

> where federal action, alone or in concert with provincial and industry partners, can lead to real and visible benefits for independent, safe, and dignified travel for disabled Canadian travellers.

Included in the national strategy were initiatives to deliver improved accessibility across the Canadian transportation sector. Financial incentives were provided to implement the widespread introduction of boarding systems for small aircraft and passenger rail; to improve ground transportation at airports (accessible taxis, rental automobiles, and airport shuttle buses); and to make a major impact on intercity bus travel in Canada.

1.4 Provincial Policies

In parallel with the federal government's transportation initiatives, the provinces have also taken action to assist persons with disabilities. British Columbia, Ontario, and Alberta have been particularly strong proponents of accessible transportation.

All the provincial and territorial governments in Canada have enacted human-rights legislation to protect persons with disabilities from discrimination. In addition, several provincial administrations that support public transit systems financially have adopted accessibility policies and objectives.

In 1989, BC Transit, a provincial Crown corporation, became the first Canadian transit organization to adopt and implement a policy of full accessibility. The first 86 lift-equipped, full-sized urban transit buses were put into service on 22 routes in the Vancouver region in September 1990. By the end of 1995, this fleet contained 302 lift-equipped buses. By July 1997, 162 low-floor buses, including five minibuses, were in operation. All non-accessible vehicles in the regional fleet are expected to be replaced with low-floor buses by the year 2006. The Ontario Ministry of Transportation has adopted a policy of full accessibility for regular transit services. To ensure that this policy is implemented at the municipal level, all transit agencies have been required to develop broad-based accessibility plans. In addition, the ministry will subsidize only low-floor buses accessible to wheelchair users and transit terminals designed to be fully accessible. Ontario has also provided capital assistance for the purchase of accessible taxis.

In Alberta, the Premier's Council on the Status of Persons with Disabilities took up the challenge of acting as a catalyst to bring about change within provincial and municipal jurisdictions. In 1989, the council prepared an action plan outlining a series of recommendations designed to achieve the following objective:

> Barrier-free transportation systems within the province that meet transportation needs for local and intraprovincial travel ... by the year 2000 (Alberta, 1989).

1.5 Municipal Policies

Several hundred municipalities in Canada are involved in the delivery of accessible bus, van, taxi, and parking services to seniors and persons with disabilities (Canadian Urban Transit Association, 1993). Some of the larger municipalities have formally adopted programs to increase accessibility on their mainstream public transportation systems. For example, OC Transpo's 1994 *Accessibility Plan for Transit in Ottawa-Carleton* outlines the agency's commitment to developing a more accessible transit system. Notable in this plan is the intention to replace, gradually and at substantial cost, OC Transpo's entire vehicle fleet by low-floor buses. The program includes recommendations to ensure that future Transitway stations are accessible, and to make existing Transitway stations as accessible as is reasonable through a program of improvements (OC Transpo, 1994).

1.6 Canadian Manufacturers

The Canadian transportation industry has taken a leadership role in developing accessible buses, as shown in Table 1.1. Numerous examples of other Canadian

achievements in specialized level-change technology, mobility devices, and communications systems can be found throughout this guide.

Canadian manufacturers of transportation vehicles and related equipment are highly dependent on export markets, particularly those in the United States. Standardized, universal designs for accessible vehicles are being produced by Canadian manufacturers for domestic and export markets. The availability of accessible vehicles is encouraging Canadian carriers to make their systems and terminal facilities more accessible.

1.7 National Transportation Associations

1.7.1 Canadian Bus Association

The Canadian Bus Association (CBA) represents many of the intercity bus companies in Canada and acts as a leader in the bus-operating community to improve services for persons with disabilities. Other provincial bus associations, such as the Ontario Motor Coach Association (OMCA), also represent many carriers. With the assistance of Transport Canada, CBA launched a full-accessibility training program for its members. This program has been implemented by companies such as Acadian Lines (SMT), Voyageur Colonial Limited, Ontario Northland Transportation Commission (ONTC), Saskatchewan Transportation Company (STC), and Greyhound. CBA has conducted a recent survey of accessible bus services (see Section 15.2).

1.7.2 Canadian Urban Transit Association

The Canadian Urban Transit Association (CUTA) is a national association representing the urban transit community in Canada, including operators, government agencies involved in providing subsidies to the industry, equipment suppliers, manufacturers, consultants, educational institutions, and individuals interested in public transit.

CUTA provides valuable support services to its members in research, training, and government relations, and is the only national forum for dealing with accessible transit issues. It is also the recognized source for statistical data and information about the provision of accessible transit services in Canada. CUTA obtains data from member transit systems and uses the data to calculate industry indicators and to monitor industry trends. CUTA has developed sensitivity-training programs, sponsored studies of low-floor bus technology, assisted in the development of national standards, and undertaken research into the needs of passengers with literacy problems.

1.7.3 Transportation Association of Canada

The Transportation Association of Canada (TAC) brings together transportation professionals and officials from every mode and from both government and private sectors. The association began as the Canadian Good Roads Association in the early days of highway building. Today, it is the catalyst organization for obtaining consensus on road design standards, traffic control devices, signing, road capacity, and pavement management practices. An urban transportation policy was adopted for Canada under the guidance of TAC. This policy was based on TAC's generic vision for the future of transportation, which includes the concept that "the physically challenged enjoy universal access to public transport facilities and services" (TAC, 1994).

1.7.4 The Air Transport Association of Canada

Since 1934, the Air Transport Association of Canada (ATAC) has represented the interests of Canada's commercial aviation industry. Today, ATAC member carriers account for more than 96 percent of all revenues earned by this industry in Canada. In addition to Canada's two major national carriers, ATAC's membership rolls include all the large aircraft charter operators, the commuter air carriers, and a significant number of helicopter, flight training, and air-taxi operators in Canada.

ATAC's Accessible Transportation Committee has been active for over 10 years. In that time the air-carrier industry has made remarkable strides in improving access for passengers with disabilities. Canadian air carriers are in the customer service business. In cooperation with consumer groups and government agencies, and through their own initiatives, ATAC member carriers will continue to improve services for passengers with special needs.

1.7.5 Canadian Ferry Operators Association

Federally incorporated in 1987, the Canadian Ferry Operators Association (CFOA) counts in its membership almost all the major ferry operators in Canada. The association's primary objective is to establish and maintain a standard of professional and technical excellence in the safe and effective operation of ferries in Canada.

CFOA considers questions affecting the interests of ferry owners and operators and takes such action as the association deems necessary to promote and protect the interests of member owners and operators. CFOA also facilitates the exchange of non-confidential information and experience.

1.7.6 Canadian Automobile Association

The Canadian Automobile Association (CAA) provides its members with knowledgeable assistance in travel planning for both automobile travel and travel by intercity carriers. The services offered include directories of accessible accommodations, travel insurance programs, and trip booking. Through its United States affiliate, the American Automobile Association (AAA), the CAA is able to obtain accessibility studies and guidelines sponsored by the AAA.

1.8 Canadian Model for Accessible Transportation

The Canadian approach to improving transportation accessibility illustrates how, over time, theory becomes practice. This approach involves three main components:

- **Technology R&D** to find solutions by providing innovative accessibility technologies and systems;
- **Funding programs** to support this development and to help bring the results to the marketplace;
- **Legislation, policy, standards, guidelines, and regulations** to ensure that accessibility improvements are available on a uniform and equitable basis.

The development and application of accessible intercity buses, supported by federal R&D programs and provincial subsidies and legislation, demonstrate the involvement of these three components, as well as the synergy between the various levels of government. Figure 1.1 shows the components, together with the major participants.

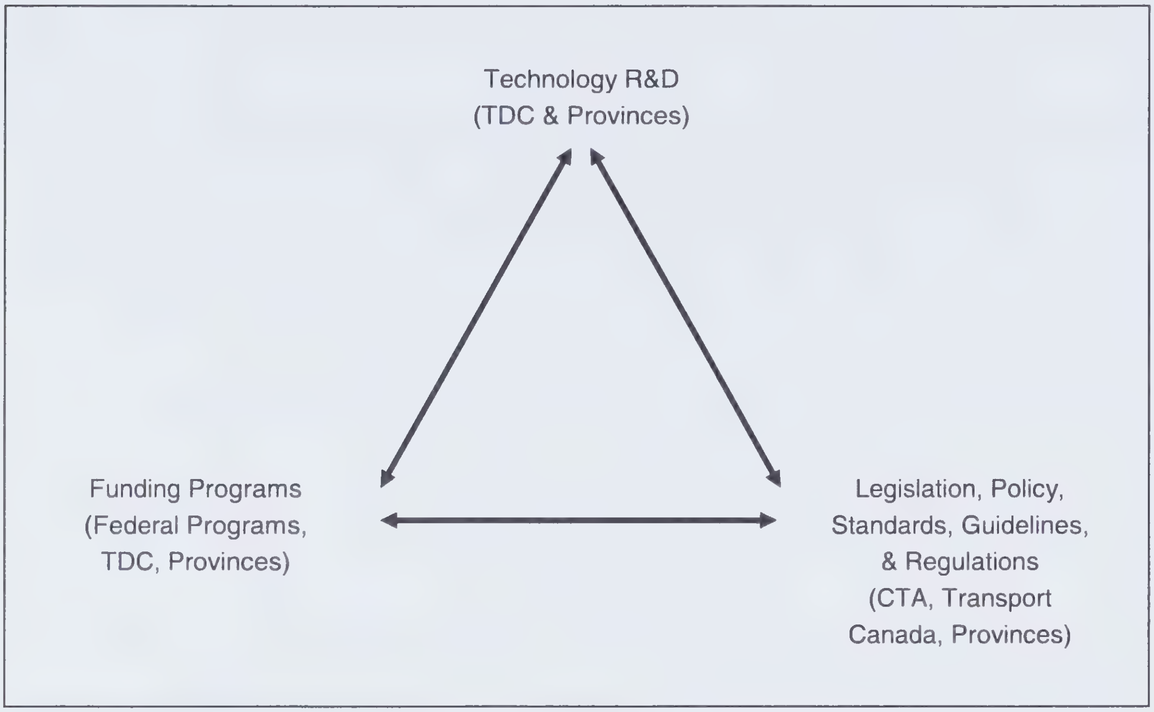


Figure 1.1 The Canadian model for accessible transportation
(Suen and Turnbull, 1995)

– 2 –

TRIP PLANNING

– 1 –
INTRODUCTION

CUSTOMER ACCESS

– 2 – TRIP PLANNING	– 3 – ROADWAYS & TERMINALS	– 4 – PERSONAL VEHICLES

SYSTEM ACCESSIBILITY

– 5 – COMMUNICATIONS SYSTEMS	– 6 – SAFETY & RELIABILITY	– 7 – TRAINING	– 8 – RESEARCH & DEVELOPMENT

PUBLIC CARRIERS: LOCAL

– 9 – ACCESSIBLE TAXIS	– 10 – URBAN BUS SYSTEMS	– 11 – URBAN RAIL SYSTEMS	– 12 – RURAL SYSTEMS

PUBLIC CARRIERS: INTERCITY

– 13 – AIR TRANSPORT SYSTEMS	– 14 – INTERCITY RAIL SYSTEMS	– 15 – INTERCITY BUS SYSTEMS	– 16 – MARINE SYSTEMS

– 17 –
MODAL INTEGRATION

Related Information: The communications systems and technology needed to facilitate access to transportation systems are discussed in Chapter 5. Linked trips are discussed in Chapter 17.

2 Trip Planning

Disabled people cannot be as spontaneous in making travel plans as the general public can. Even local trips require planning. However they travel, the key to a successful trip is planning. This places a substantial responsibility on carrier information systems, which must be designed to accommodate all needs.

Anyone with a transportation disability needs detailed planning information for every stage of a trip. Adequate planning information systems help to relieve anxiety so that travellers can enjoy their trips.

Planners and designers of public transportation information systems must ensure that prospective customers have sufficient planning information so that they can:

- compare and verify the services offered by different methods of travel before selecting a carrier (travel agents often help with this task);
- understand the carrier's rules and regulations, schedules, the days that service is offered, travel times, routings, and connections;
- find out the charges for specific services;
- tell the carrier(s) of any special needs of the person travelling and determine whether any documentation is required.

Travel agents and carriers need a wide knowledge of travel options if they are to help disabled travellers using different methods of transportation, including private vehicles for both urban and long-distance trips.

The potential market for such travel counselling, based on 1995 projections, for a three-month period, included the following (Turnbull and McKenzie, 1995):

- 307,000 persons with disabilities making 614,000 trips by air;
- 248,000 persons with disabilities making 544,000 trips by intercity bus;
- 202,000 persons with disabilities making 474,000 trips by marine transportation;
- 68,000 persons with disabilities making 143,000 trips by rail;
- 1,672,000 persons with disabilities making 13.9 million long-distance trips by private vehicle.

The TransAccess™ Information Base also notes that, of the 2.9 million people with disabilities who are able to make long-distance trips, 500,000 (17.2 percent) reported difficulty in obtaining information on specialized services and facilities.

2.1 Travel Guides

Existing travel guides published by carriers and local, provincial, territorial, and national organizations offer examples of the type of planning information needed

by travellers with disabilities. The following are the principal sources of planning guides for people with disabilities:

- the regional offices of the major air, rail, bus, and marine carriers;
- provincial tourism agencies, which provide travel guides, often updated annually, that include listings of accessible accommodation and visitor attractions;
- Canadian Automobile Association offices (annual tour guides);
- specialized travel agencies that serve tourists with disabilities;
- local associations *for* and *of* persons with disabilities;
- local chambers of commerce or boards of trade offices;
- local action groups for consumers with disabilities;
- local social planning and social service agencies;
- rehabilitation centres and hospitals;
- local service clubs (Lions Club, Rotary Club, Kinsmen, Junior League);
- community colleges and universities;
- physiotherapy centres;
- commercial travel guide books.

2.1.1 National Guides

The following are some of the national sources for guides to travellers with disabilities. For up-to-date information on specific transportation services the reader should contact the carriers directly.

VIA Rail Canada

In 1991, VIA Rail Canada published *Services for Passengers with Special Needs*. The publication includes specific guidelines for passengers who:

- have allergies
- have visual impairments
- use guide dogs
- require service in their sleeping accommodation
- are diabetic
- are mobility impaired, including seniors
- have developmental disabilities
- require stretcher service
- require special meals
- require escorts
- use respirators
- have speech or hearing disabilities
- use wheelchairs or scooters

This brochure may be obtained from VIA Rail customer services at:

Customer Relations Department
VIA Rail Canada Inc.
P.O. Box 8116, Station A
Montreal, Quebec H3C 3N3

Toll-free telephone numbers for railway schedules and special service requests are also available in all areas (consult a local telephone directory).

Canadian Transportation Agency

The Canadian Transportation Agency (CTA) has published several brochures to assist travellers with disabilities. These include *Fly Smart* and a brochure entitled, *Obstacles? It's time to remove them!*, which is designed to assist travellers with disabilities who encounter barriers or obstacles when travelling on federally regulated transportation services. It contains forms and describes how to complain to the CTA about undue obstacles for travellers with disabilities. The brochure can be obtained from the CTA. Telephone: 1-800-883-1818 or (819) 997-6828; TTY/TDD: 1-800-669-5575 or (819) 953-9705; fax: (819) 953-6019.

Transport Canada

In 1995, Transport Canada published a summary of accessibility projects funded under the National Strategy for the Integration of Persons with Disabilities. This booklet highlights companies that received funds to help purchase accessible equipment or vehicles, including the following:

- accessible taxis to serve airports;
- accessible airport limousines;
- accessible airport shuttle buses;
- accessible rental vehicles available at airports;
- rental vehicles equipped with hand controls, and available at airports;
- small-aircraft boarding systems and transfer chairs;
- intercity bus transportation;
- accessible trains;
- accessible transportation in small urban and rural communities.

The booklet contains the following advice: "Most of these vehicles are equipped with a lifting device or ramp allowing a passenger to remain in their wheelchair. When making reservations, please indicate if you require boarding assistance. It should be noted that this list is not representative of the full range of accessible services offered by each company."

The booklet *Accessible Transportation Services Across Canada* is available from Transport Canada. Telephone: 1-800-665-6478; TTY/TDD: 1-800-823-3823.

2.1.2 Local Guides

Local associations and advocates for mobility, along with urban transit systems, have produced numerous local transportation guides. For example, an excellent brochure on *Getting Around on an Electric Wheelchair or Scooter* was developed by an *ad hoc* committee in Vancouver.

Local travel guides are often concerned only with building accessibility. They use two approaches. One is to list all buildings in the community and rate them for accessibility; the Oakville *Accessibility Guidebook* and the *Kitchener-Waterloo Travel Guide* are examples. The other approach is to list only the accessible buildings and rate their accessibility. Examples are the Winnipeg *Easy Wheeling* guide and the *Access Montreal* guide.

Regional travel guides usually include two or more local communities. They concentrate on accessible public buildings, which may include hotel and motel accommodation as well as campsites. Examples are the *Region of Peel Guide*, the *Accessibility Guide in the National Capital Region* and the *Accessibility Guide for the Nine Communities in the Richelieu-Yamaska Region of Quebec.*

2.1.3 Provincial Guides

Accommodation and travel guides are usually published by the tourism departments or ministries of provincial governments. Some of these guides are developed specially for persons with disabilities, and they supplement the general tourist accommodation guides. Examples of these are found in Nova Scotia, Ontario, and British Columbia. Other accommodation guides, such as one published by the Government of Alberta, are for general use, with a wheelchair symbol denoting accessibility. Accommodation includes public campsites as well as hotel and motel facilities.

2.1.4 International Guides

National travel guides are published by the tourist bureaus of most European countries and are available through Mobility International in London, England. These guides list tourist boards and organizations that offer services. Accessibility criteria are fairly standard. All accessible facilities are rated.

British Airways publishes excellent guides for travellers with disabilities, including a guide to Heathrow International Airport.

2.2 Information Services

The federal government provides programs, information, and publications for persons with disabilities. Several issues are addressed:

- access
- education
- employment
- health, safety, and social service
- human and civil rights
- income support
- independent living
- information/communications
- policy
- research
- self-help/advocacy support
- sports/leisure
- transportation

Local offices of Reference Canada can help locate a federal government service or program. Toll-free telephone numbers are also available: 1-800-667-3395, TTY/TDD: 1-800-465-7735.

Similar services are provided by most provincial and territorial governments. For current information, check in the reference section of the telephone directory.

2.3 Printed Timetables

Printed timetables are troublesome for most travellers. At best they are a compromise between the level of detail needed by travellers and travel agents, and the practical size limitations of a portable document. Timetables are even more cumbersome if they include route maps and explanations of services offered, travel regulations, and the carrier's tariffs. The practice of reducing the print size to include all the information creates problems for people who cannot read small print.

Urban transit systems have struggled with these issues and have partially solved the visual problems by producing separate timetables for each bus route. The major transit systems, such as those in Ottawa, Toronto, and Montreal, issue timetables in two or more languages and may have a Braille and/or large print version (see Section 2.4.2 for design guidelines for timetables).

2.4 Guidelines for Planners and Designers

System and service planners should understand how customers with disabilities or their agents have to plan trips.

The following steps are usually taken to select a major transportation carrier:

- obtaining information on accessible service options;
- selecting the major carrier or carriers with the least stressful accommodation;
- determining the availability and location of accessible facilities, including food services and washrooms;
- reviewing alternative means of travel;
- booking travel and overnight accommodation (if necessary).

2.4.1 Information Systems

Customers with disabilities must plan even local trips. This places a greater load on carrier information services, which must be designed to accommodate a broad range of needs (see Section 5.2 for a discussion of communications technology).

The most important requirement for non-automated information systems is that carrier personnel listen carefully to potential customers. For example, the Alberta Government Telephones (AGT) directory assistance service uses the term "code blue" to alert information operators to customers with special needs. A "code blue" customer is one who is unable to use a telephone directory and therefore requires the personal assistance of an operator. Customers using the term "code blue" immediately get the operator's attention without having to explain the nature of their disabilities. Similar devices could be used to identify special needs without embarrassing customers.

For older seniors and for many travellers with disabilities, the long walks and level changes in many major transportation terminals may be very stressful. Some methods of travel may raise so many problems that they are eliminated in the early stages of trip planning.

The following are some of the questions asked by potential customers when selecting a major carrier:

- Is the carrier fully accessible?
- Are there suitable connections at either end of the trip?
- Does the carrier provide attendants to assist in boarding procedures, or must the customer provide such assistance?
- Is there accessible parking close to the terminal?
- Do they provide for guide dogs?
- How much advance notice is needed for special services?
- What accessible communications and facilities are provided by the carrier?

- In case of a service disruption, what are the travel alternatives?
- How will the carrier identify the special needs of the traveller?
- What charges will be incurred for special services (e.g., an oxygen bottle)?

2.4.2 Timetable Design

The following guidelines for timetables were excerpted and updated from a design manual commissioned by the Ministry of Transportation of Ontario (Geehan, 1978). Timetables should include these features:

- a simple, easily understood schematic map that highlights the carrier routes only;
- cues showing trip starts, ends, and times;
- a legend explaining all symbols and markings used, including a list of route names and numbers;
- a user-information section explaining how to read the map and timetable;
- a customer-information telephone number for further assistance;
- appropriate use of graphics and colour based on ergonomic principles.

Guidelines for using graphics and colours include the following:

- Names and places should have a basis in the geography of the community and should have meaning to the public.
- Lettering size and type are important. Helvetica medium is widely used in Europe, and, because it is easy to read, has practically become the transit standard. In some cases, Universe is used. These sans serif designs are noted for their simplicity and legibility.
- The smallest type size should be 8 point, although 10 or 12 point is preferred. The type size used in tables in this guide is 10 point.
- Lower-case lettering is slightly easier to read, and generally provides a more attractive heading format.
- The maximum number of colours should be five. If there are more than five routes, use different symbols for the routes and colours for something else.
- Various studies have shown some colour combinations are more effective. On a white background, preferred colours are: (1) black, (2) blue, (3) green, (4) red, (5) orange. Soft pastel colours should be avoided.
- Symbols, such as pictographs, can be used to denote points of interest and are probably more effective than names.
- Do not use more than ten symbols on a route guide; the fewer symbols used, the more easily they are recognized. The most distinctive shapes are the circle, the rectangle, the cross, and the triangle. Squares, polygons, and ellipses should be avoided, as well as variations of a single geometric form.

2.4.3 Rating Accessible Facilities

For many seniors and travellers with disabilities, the use of washroom facilities and food services must be planned. For example, a customer who needs access to washrooms or food and beverages at frequent intervals might choose to depend on intermediate rest stops and/or terminal facilities. Long, unexpected delays in service can upset passengers who need food and medication at regular intervals.

If travellers depend on carrier facilities, problems can occur during construction, when washrooms and food services may be temporarily relocated. During such periods, carrier agents need to be particularly alert to customers with special needs.

Under normal circumstances, access to facilities varies greatly and travellers would benefit from some form of rating system. The Alberta Hotels Association (AHA) has published a hotel operator's accessibility manual that can be used to rate accommodations within four levels, depending on the severity of customers' disabilities. The rating levels are as follows:

A Level 1 facility will accommodate

- seniors with normal aging;
- people with limited hearing, vision and agility, and mild disabilities.

A Level 2 facility will also accommodate

- people with mild hearing impairments;
- people with limited stamina/strength/agility, e.g., seniors;
- people with mild visual impairments.

A Level 3 facility will also accommodate

- people with moderate hearing impairments;
- people with moderate visual impairments;
- people who are independent wheelchair users.

A Level 4 facility will also accommodate

- people who are deaf;
- people who are blind;
- people who are dependent wheelchair users.

The manual contains detailed worksheets to assess all facets of the accommodation, including portable equipment and training, to arrive at a rating.

2.4.4 Travel Alternatives

Most travellers like to have travel alternatives, particularly in case of service disruption. Unfortunately, many travellers with disabilities have no feasible alternatives. For example, a wheelchair user who is travelling independently may select air travel because there is assistance in boarding. Such a person might be stranded if the airport were closed due to weather conditions. Alternative carriers who could provide fully accessible service could fill this market niche.

2.4.5 Booking Trips

The reservation systems used by major airlines and VIA Rail are capable of encoding special needs in their electronic files. The systems used by other carriers to date are not as automated. At present there is no universal system for encoding special needs. Service planners and designers should be guided by the successful methods used by the major carriers.

For trips by intercity bus and by urban and commuter rail and bus systems, travellers must contact the carriers' information services directly. Trips on VIA can be booked through travel agents. Fortunately, most local systems and carrier agents are very knowledgeable about the needs of customers with disabilities. They will often provide special assistance, as long as they are informed of a customer's needs in advance. For example, VIA Rail is able to accommodate and confirm a special service request if given at least 48 hours in advance.

When customers wish to use feeder transportation services at a distant location, they should contact the carriers in advance to determine what accessible services are available. The telephone numbers of local taxi, transit, and paratransit services can be obtained from the telephone directory assistance service. In the case of paratransit services, which are often independent of the transit system, one should ask for the local handy-bus system. In Quebec the service is called *Transport Adapté*, and in British Columbia it is called custom transit or handyDART. The local transit system may be able to help locate the service. Intercity bus and rail carriers are often knowledgeable about local accessible feeder systems. Local advocate agencies and tourist bureaus may also be helpful.

Both major Canadian air carriers and their connecting carriers have systems that keep permanent records of a passenger with a disability. Using their own telephone number as the permanent reference, frequent flyers can have all their special needs and any medical approvals kept on file. This avoids the need constantly to explain or describe special requirements or to reapply for travel authority should it be required. The major carriers offer toll-free TTY/TDD access for passengers with hearing disabilities.

Airlines that are members of the International Air Transport Association (IATA) may be able to provide a Frequent Travellers Medical Card (FREMEC). This card is issued free to any traveller with a permanent disability who the airline's medical officer is satisfied has a stable medical condition. It does not reduce the need for informing the airline of special needs in advance.

Information on accessible intercity bus services that have been implemented recently can be obtained from Transport Canada. Telephone: 1-800-665-6478; TTY/TDD: 1-800-823-3823.

2.4.6 General Guidelines and Sources of Assistance

The most important aspect of trip planning is to ensure that the travel guides are updated and reissued on a regular basis. For assistance with the design of travel information service, planners should consult the following:

- Section 5.2.1 for communications media and technology;
- Section 17.2 for multimodal travel planning;
- Carriers that have developed specialized customer reservation tracking systems including the airlines, VIA Rail, the Greyhound Group of Companies, and the large paratransit systems in major cities.

– 3 –

ROADWAYS AND TERMINALS

– 1 – INTRODUCTION

CUSTOMER ACCESS

– 2 – TRIP PLANNING	**– 3 – ROADWAYS & TERMINALS**	– 4 – PERSONAL VEHICLES

SYSTEM ACCESSIBILITY

– 5 – COMMUNICATIONS SYSTEMS	– 6 – SAFETY & RELIABILITY	– 7 – TRAINING	– 8 – RESEARCH & DEVELOPMENT

PUBLIC CARRIERS: LOCAL

– 9 – ACCESSIBLE TAXIS	– 10 – URBAN BUS SYSTEMS	– 11 – URBAN RAIL SYSTEMS	– 12 – RURAL SYSTEMS

PUBLIC CARRIERS: INTERCITY

– 13 – AIR TRANSPORT SYSTEMS	– 14 – INTERCITY RAIL SYSTEMS	– 15 – INTERCITY BUS SYSTEMS	– 16 – MARINE SYSTEMS

– 17 – MODAL INTEGRATION

Related Information: Safety issues are discussed in Chapter 6. Access to and egress from transportation vehicles are discussed in the chapters on individual modes.

3 Roadways and Terminals

All travellers begin and end their trips as pedestrians. For a trip to be successful, therefore, the street systems, parking areas, and terminal facilities must be accessible to pedestrians, including people using wheelchairs and scooters. The nature and quality of the accessibility have a significant impact on overall customer and community transportation costs. The ease with which travellers can use competing methods of transport comfortably, conveniently, and safely influences their choice of carrier. For people with disabilities, good pedestrian design from doorstep to doorstep is essential. Chapter 3 includes guidelines for achieving accessible pedestrian design and for planning and designing access to passenger terminal facilities.

3.1 Accessibility Issues

Communities must resolve numerous local issues on pedestrian access and safety. Many issues arise from a lack of universal design standards for the urban infrastructure while others may arise from a lack of public understanding of the warrants and standards used by traffic engineers to determine the need for signs, traffic signals, and crosswalk markings.

A substantial amount of research, carried out during the past 10 years, has led to a better understanding of the needs of disabled pedestrians and the technology that can be used.

Major concerns in the 1990s include the following:

- evaluation data and standards for audible traffic-signal technology;
- upgrading of older air, bus, and rail transportation terminals to reduce walking distances and improve accessibility;
- development of more comprehensive urban design standards and guidelines that go beyond existing building codes;
- improvement of the links between transportation modes to reduce the number of level changes required and the walking distances involved.

3.2 Regulation

In Canada, the responsibility for pedestrian design is shared between municipal agencies responsible for their street systems and the federal, provincial, and private agencies developing transportation terminals. The Canadian Transportation Agency (CTA) has regulatory responsibilities for terminals within the federal transportation network (see Section 6.1.7).

3.2.1 Pedestrian Traffic Regulation

Pedestrian crossing systems are part of the overall street and roadway systems regulated first by the provincial and territorial motor vehicle acts, and second by the traffic bylaws of municipal governments. For example, the British Columbia Motor Vehicle Act (RSBC 1979, Chapter 288, Part 3, Section 115, as amended) defines a crosswalk as:

> A portion of the roadway at an intersection or elsewhere distinctly indicated for pedestrian crossing by signs or by lines or other markings on the surface; or the portion of a highway at an intersection that is included within the connection of the lateral lines of the sidewalks on the opposite sides of the highway, or within the extension of the lateral lines of the sidewalk on one side of the highway, measured from the curbs, or in the absence of the curbs, from the edge of the roadway.

The Act stipulates the duties of both vehicle drivers and pedestrians. It states that "a pedestrian shall not leave a curb or other place of safety and shall not run into the path of a vehicle which could not be stopped in time". It also states that "when a pedestrian is crossing a highway at a point not in a crosswalk, the pedestrian shall yield the right-of-way to a vehicle".

Provincial motor vehicle legislation does not specifically address the needs of seniors or people with disabilities – they are considered as pedestrians in general and therefore must observe the standard rules.

3.2.2 Crosswalk Standards

The *Manual on Uniform Traffic Control Devices for Canada*, published by the Transportation Association of Canada (TAC), outlines crosswalk standards. Supplementary publications by TAC and the Institute for Transportation Engineers (ITE) provide guidelines for the installation, signing, and pavement markings for crosswalks.

Typical design standards for urban streets result in crossing widths ranging from about 18 m for local streets and arterials to 26 m for six-lane urban highways. Crossing speeds of most pedestrians range from about 1.0 m/s up to about 1.4 m/s for pedestrians crossing in groups. Most traffic signals are set for an average crossing speed of about 1.2 m/s . This speed translates into typical crossing times of from 15 to 22 seconds. Studies of the needs of seniors in Sweden showed that a walking speed of 0.9 m/s would accommodate most needs and a speed of 0.6 m/s would accommodate all but the very slowest. These speeds translate into average crossing times of about 30 seconds for a four-lane roadway (Atkinson, 1984).

3.2.3 Access to Terminal Buildings

The National Building Code of Canada (NBCC), published by the National Research Council, and various provincial and territorial building codes deal with access to buildings. Federal buildings must adhere to Public Works and Government Services Canada guidelines and the Canadian Standards Association National Standard of Canada on *Barrier Free Design* (CAN/CSA-B651-95).

The NBCC is used throughout Canada as a basis for provincial building code legislation. Four provinces – Alberta, British Columbia, Manitoba, and Ontario – have separate provincial building codes that include the standards set out by the NBCC and certain other standards. Nova Scotia and Saskatchewan have adopted the NBCC as the actual code for the province and also have legislation implementing accessibility standards. New Brunswick, Newfoundland and Labrador, Northwest Territories, Prince Edward Island, Quebec, and Yukon Territory have adopted the NBCC as the code for their jurisdictional areas.

The majority of Canadian building codes focus largely on accessibility for persons with physical disabilities and contain little material on adaptations and design for sensory impaired persons. A recent study by the Canadian National Institute for the Blind (CNIB) included a review of building codes and accessibility guidelines in several provinces. The study concluded that the British Columbia Building Code contained the most extensive section on building requirements for persons with disabilities (Richesin, 1987).

3.3 Urban Street Systems and Technology

Street systems include:

- curb cuts for wheelchairs
- crosswalk systems
- bus stops
- street furniture (benches, shelters, garbage containers, and advertising signs)
- on-street passenger terminals

3.3.1 Curb Cuts for Wheelchairs

Most urban communities have installed curb ramps for wheelchair users. The design of these ramps varies somewhat from community to community, depending on local experience and topography. Initially, curb ramps were often located in the path of travel. Subsequent experience and research by the CNIB and others indicated that, for the benefit of pedestrians with impaired vision, curb ramps should

not be in the direct path of travel. Alternatively, where there is not sufficient space to offset the curb ramp, a change in surface texture preceding the ramp should be used as an indicator (Richesin, 1987).

3.3.2 Crosswalk Systems

In 1984, TDC initiated a series of investigations into the safety of seniors and persons with disabilities when using urban street systems (Atkinson, 1984; Atkinson, 1986; Atkinson, 1987). The initial research into crosswalk systems concluded that if urban crosswalk systems were generally more accessible, they would be adequate for seniors and pedestrians with disabilities. The more specific needs of pedestrians with particular dysfunctions – visual impairments, for example – can be met by applying such technologies as audible crosswalk signals. Better urban design can overcome the current crosswalk system deficiencies. Key elements that could resolve both accessibility and safety deficiencies are:

- national, provincial, and local building codes
- the *Manual of Uniform Traffic Control Devices for Canada*
- national standards of accessibility
- national urban design guidelines

National organizations concerned about traffic safety and the welfare of seniors and persons with disabilities have an important role to play, both in creating an awareness of the needs and in lobbying the responsible agencies for better crosswalk design.

The TDC-sponsored study of crosswalk systems resulted in some valuable guidelines and recommended practices for good crosswalk design:

- Avoid oblique-angled crosswalks. If an oblique-angled crosswalk is necessary because of the street layout, then at least one of the marking lines should be retained at 90 degrees to the curb, where it is practical to do so.
- Avoid locating crosswalks where they are hidden from the view of drivers or where pedestrians are hidden from view by trees, planters, and other planting materials.
- Avoid locating street furniture, poles, and mail boxes on the sidewalk close to the crosswalk, where they may hide pedestrians from view.
- Except where sidewalk extensions are provided, parking should not be permitted within 6 m of the nearest crosswalk. Parking should not be permitted within 9 m of the nearest crosswalk at intersections with traffic signals.
- Crosswalk widths should be based on calculated pedestrian volumes. (The Canadian standard is a minimum of 2.5 m.)

- Where there is likely to be a considerable number of seniors and persons with disabilities and heavy volumes of vehicular traffic, the crosswalk length should be not greater than 23 m if no refuge island is provided.
- Traffic signal timing should be calculated to take into account the longer crossing times needed by seniors and persons with disabilities.
- Wherever possible, crosswalk length should be reduced by extending the sidewalk out to the edge of the parking lane.
- Crosswalk markings should have slip-resistant surfaces. Crosswalks should not use paving materials in small units with many joints. Boundary lines should be detectable to people with visual impairments.
- Special consideration should be given to crosswalk curb junctions to ensure that they can be used by visually impaired people who use canes or guide dogs.
- At crosswalks with substantial pedestrian traffic, sufficient waiting space should be provided on the sidewalks, wherever possible.
- Manholes, gratings, and other access covers should not be located within crosswalks if possible. If this cannot be avoided, then they should be made easily visible and slip resistant.
- Crosswalks should be regularly maintained to remove hazardous debris.

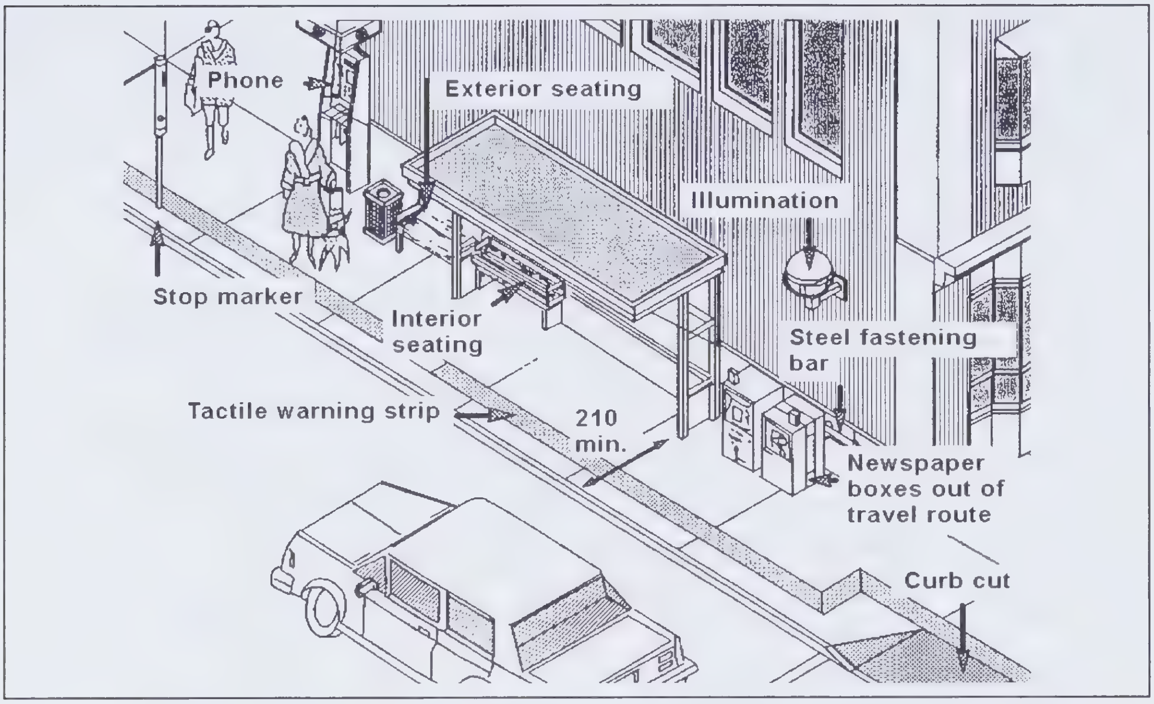
3.3.3 Location of Accessible Urban Bus Stops

The design and location of accessible urban bus stops is discussed in considerable detail in Chapter 8 of the *Canadian Transit Handbook* (CUTA, 1993). Individual transit agencies have developed guidelines for their bus systems. Recent examples include guidelines published by Calgary Transit, the Toronto Transit Commission, the Hamilton Street Railway, and BC Transit.

There are no universal standards for the location of bus stops. Transit authorities in western Canada prefer to locate bus stops on the far side of an intersection, while others, such as the Toronto Transit Commission, prefer nearside locations. To a large extent, the locations are determined by geographic conditions and by potential conflicts with turning movements by vehicular traffic.

3.3.4 Design of Bus Stops and Street Furniture

Figures 3.1 and 3.2 are reproduced from BC Transit's *Design Guidelines for Accessible Bus Stops* for low-floor buses. They show the consideration given to the safety and security needs of all transit customers.



(Dimensions in cm)

Figure 3.1 Typical urban bus stop design – High-density location
(BC Transit, 1992)

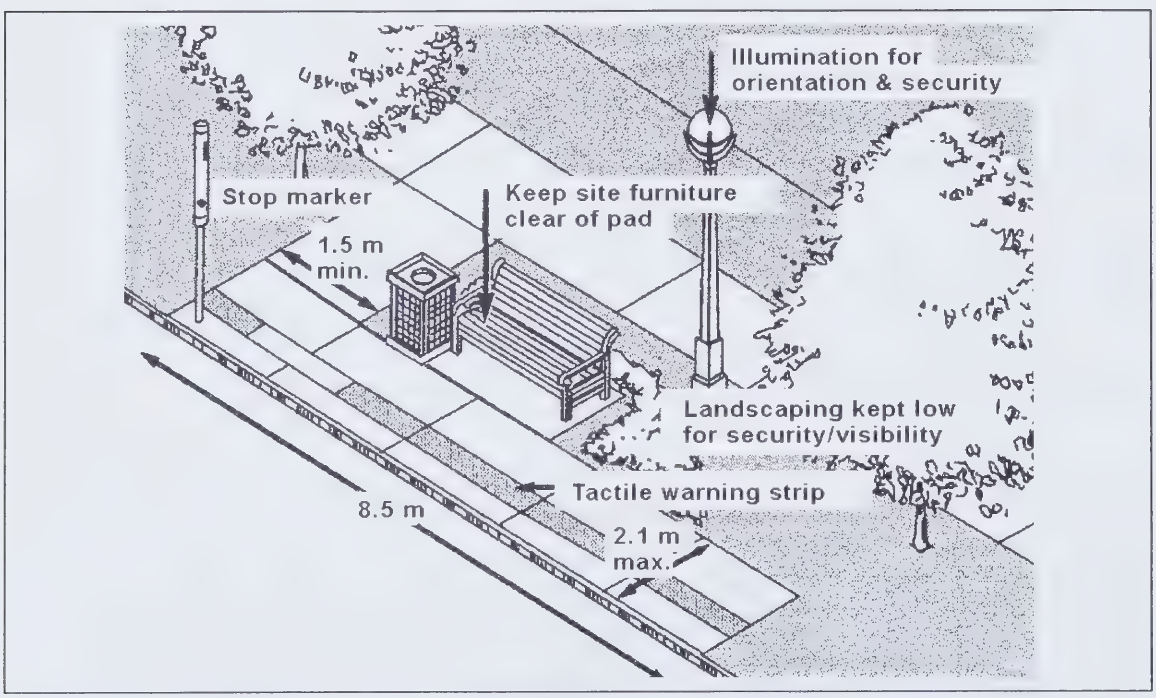


Figure 3.2 Typical suburban bus stop design – Low-density location
(BC Transit, 1992)

3.3.5 On-Street Passenger Terminals

Several techniques are used to provide street terminals, including:

- building set-backs at the street level to provide shelter for waiting passengers;
- installing multiple shelters, serving assigned routes;
- creating bus bays in the entrances to shopping centres;
- creating island terminals within one-way street systems and service roads.

If not carefully designed, these techniques could create additional hazards and barriers for pedestrians with disabilities.

3.3.6 Access to Off-Street Passenger Terminals

The following guidelines are intended to ensure that customers with disabilities have easy access to passenger terminal entrances:

- Signs should direct drivers with disabilities to accessible parking areas.
- Parking spaces for persons with disabilities should be close to the terminal check-in and should be sheltered against inclement weather.
- The international symbol of access should be painted on the surface of each parking space reserved for persons with disabilities. Use walkway strips to encourage drivers to leave sufficient space between cars to meet the clearance requirements (see Figure 3.3).
- In very large terminals, accessible shuttle buses to and from parking areas may be required.
- Shelters should be provided at bus and taxi waiting points, as well as at automobile drop-off and pick-up points. Shelters should provide refuge from weather conditions and may provide a choice of sunny or shaded areas. Shelters should house such features as transit maps and Braille maps. A taxi call box should be located inside the shelter and/or the station. Shelters should have transparent sides.
- Where a ramp is necessary, stairs should be provided beside the ramp.
- Curb cuts parallel to the walkway or to the direction of travel are better than curb cuts at the ends of walkways.
- External wheelchair ramps are generally too long to be feasible for rises of over one metre. Elevators should therefore be used to complement stairs under these conditions.
- Ramps should be designed so that wheelchair users are directed gradually into conflicting traffic flows.

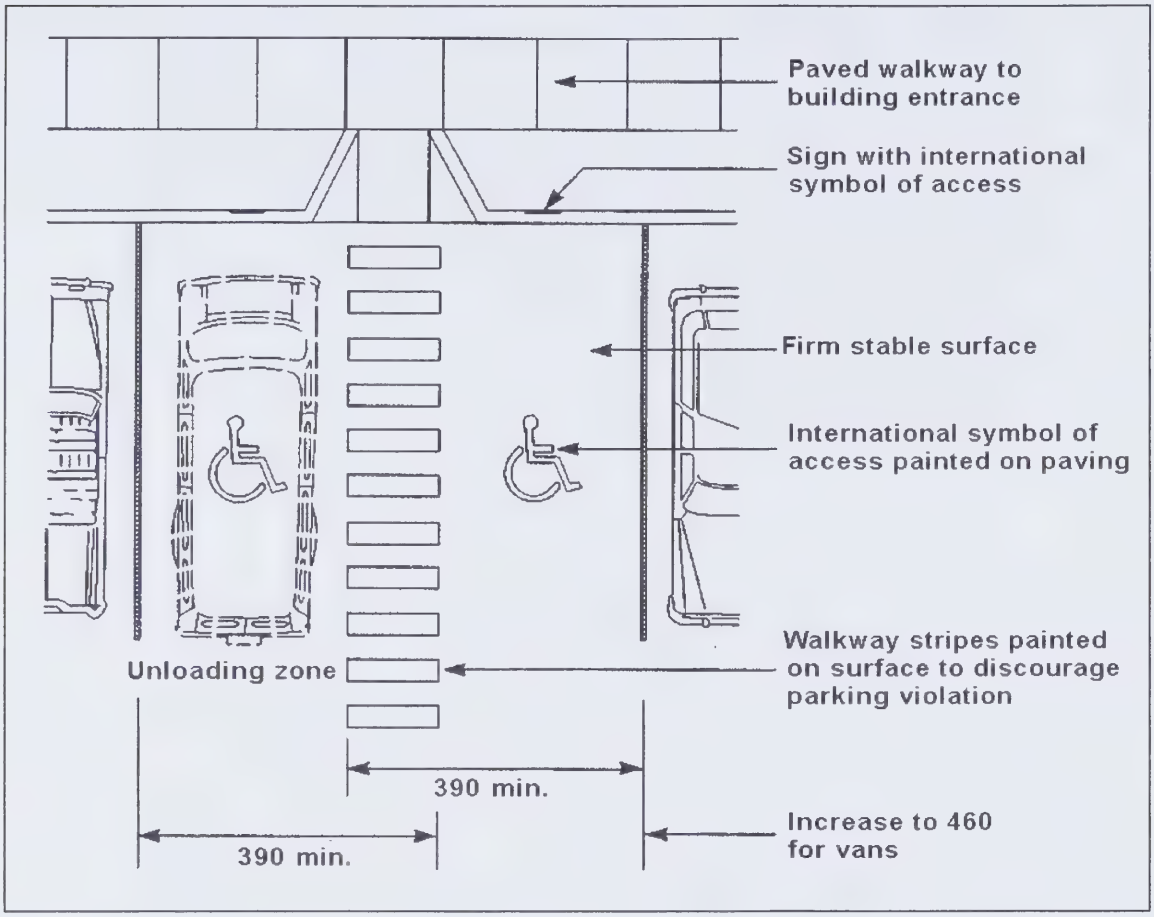


Figure 3.3 **Accessible parking areas**
(The Canadian Paraplegic Association,
An Illustrated Guide for Barrier Free Design)

3.4 Guidelines for Planning and Designing Terminals

The following guidelines should help pedestrians with disabilities negotiate passenger terminals. The guidelines were derived from several sources, including Canadian Standards Association (CSA), OC Transpo, VIA Rail, British Railways, and the *Canadian Transit Handbook*. Table 3.1 was taken from a comprehensive study of passenger access by OC Transpo. For detailed information about terminal building design, the reader should consult CAN/CSA-B651-95 on *Barrier-Free Design*.

Table 3.1 Passenger terminal design guidelines

If terminal design requires customers to	Then consider
Walk a significant distance	• Seating at regular intervals • Compact station design (reduce length) • Use of shortest paths for access
Stand for a significant length of time	• Seating in waiting areas
Use seating	• Proper seat height, slope, and shape • Supportive backrests • Supportive armrests • Signed priority seating
Wait in cold, hot, or windy areas	• Heating • Air conditioning • Shelters or windbreaks
Climb/descend curbs	• Curb cuts or curbs of limited height
Climb/descend steps and stairs or steep terrain	• Full-length handrails at grade changes • Ramps • Escalators • Elevators • Benches near stairs or ramps
Negotiate travel paths	• Level, non-slip finish, no grates or obstacles • Acceptable grades
Maintain balance and traction	• Non-slip floor finishes • Handrails and grab bars
Open doors	• Automatic doors or power door openers • Large, easy-swinging doors
Board/disembark vehicles outside terminal	• Adequately sized, designated pick-up and drop-off platform • Designated accessible parking spaces

Table 3.1 Passenger terminal design guidelines *(cont'd)*

For persons using a wheelchair or scooter who must	Also consider
Find accessible travel paths to/from stations	• Pavement markings
Change levels	• Back-up systems for elevators
Use telephones, kiosks, other amenities	• Accessible counter heights and depths, and reach distances
Manoeuvre in elevators and shelters	• Accessible designs for small spaces
Read overhead signs or video terminals	• Reduced height of information • Larger lettering • Audible messages
Board/disembark transit vehicles	• Adequately sized platform areas • Appropriate platform heights
Board/disembark vehicles outside station	• Appropriate platform/curb heights
For persons with impaired vision who must	**Also consider**
Follow travel path	• Tactile/coloured way-finding strips • Auditory pathways (via portable receiver) • Audible traffic signals
Sense and avoid obstacles	• Eliminate hazards/obstructions in travel paths • Tactile warnings or physical barriers
Identify steps/stairs	• Tactile/visual strips at top and bottom of stairs and railings • Tactile/visual strips on nose of each step • Extended railings • Railing textures near ends
Identify road at curb cuts	• Tactile warning strip
Identify glass panels/doors	• Contrasting colour markings
Identify entrances	• Contrasting colour markings
Identify edge of platform	• Visual/tactile strip at platform edge

Table 3.1 Passenger terminal design guidelines *(cont'd)*

For persons with impaired vision who must	Also consider
Identify correct vehicle at platform	• Public address system • Talking bus stops
Identify stations from buses	• Size/frequency of station identification signs • Distinct colours/features at each station • Audible messages
Read signs	• Raised lettering • Larger lettering • High-contrast colours • Complementary Braille signage • Symbols that make sense • Signs at eye level • Removal of obstructions to allow passengers to get close to signs • Adequate lighting • Non-glare finishes
Find route and schedule information	• Audible or visual signals indicating location • Centralized location • Consistent design and presentation • Tactile pathways
Read route and schedule information	• Large-print/large-format maps and tables • Braille information • Tactile information • Talking/video information • Consistent design and presentation • Adequate lighting • Non-glare finishes
Use elevator controls	• Tactile controls • Talking elevators/audio signals • Colour-contrasted controls • Raised buttons

Table 3.1 Passenger terminal design guidelines *(cont'd)*

For persons with impaired hearing who may have problems trying to	**Also consider**
Hear public address announcements	• Visual announcement system (e.g., scrolling, LED, LCD, or flip-disc) • Assistive listening devices (loop, FM, or infrared systems)
Use telephones	• Volume-control telephones • Text telephones (TDD) • Handset flux coils to assist hearing aids • Telephone location away from noise sources or behind sound barrier
Hear emergency warnings	• Visual warning systems (strobes)
For passengers with speech impairments who may have problems trying to	**Also consider**
Speak to staff	• Provision of notepads or boards
Use public, emergency, or information telephones	• Text telephones (TDD)
For passengers with cognitive disabilities who may have problems trying to	**Also consider**
Understand complex or competing messages	• Fewer messages with simplified text • Uniform sign design and terminology • Uniform identification of station elements • Removal of distractions (e.g., advertising) from message and sign areas • Reduction of noise levels to ensure important sounds (e.g., warnings) are clear
Follow complex travel paths	• Simplified orientation using right angles • Consistent messages at decision points • Repeated messages at intervals
Orient self in large open spaces	• Breakdown of large spaces into smaller, more comprehensible areas • Memorable visual cues and landmarks

Table 3.1 Passenger terminal design guidelines *(cont'd)*

For passengers with cognitive disabilities who may have problems trying to	Also consider
Comprehend textual signs	• Minimized use of text • Use of colours/pictograms/accepted symbols
Communicate with staff	• Training
Perceive or respond quickly	• Provision of appropriate response times by automated systems
Deal with unexpected situations	• Immediately recognizable information and emergency facilities
Identify correct vehicle at platform	• Public address system • Talking bus stops • Signage

(OC Transpo, 1994)

3.4.1 Entrances

Entrances should be designed according to local building codes and CSA standards:

- Areas on both sides of the doorways should be clear and level for at least 6 to 7.5 m.
- Principal terminal entrances and exits should be universally accessible. Doors should be the automatic sliding type wherever feasible.
- Doors should be designed so that they do not conflict with natural pedestrian traffic flows.
- Raised thresholds or sills should be avoided wherever possible.

3.4.2 Counters

Figure 3.4 illustrates good design practice for customer-service counters that accommodate persons with disabilities.

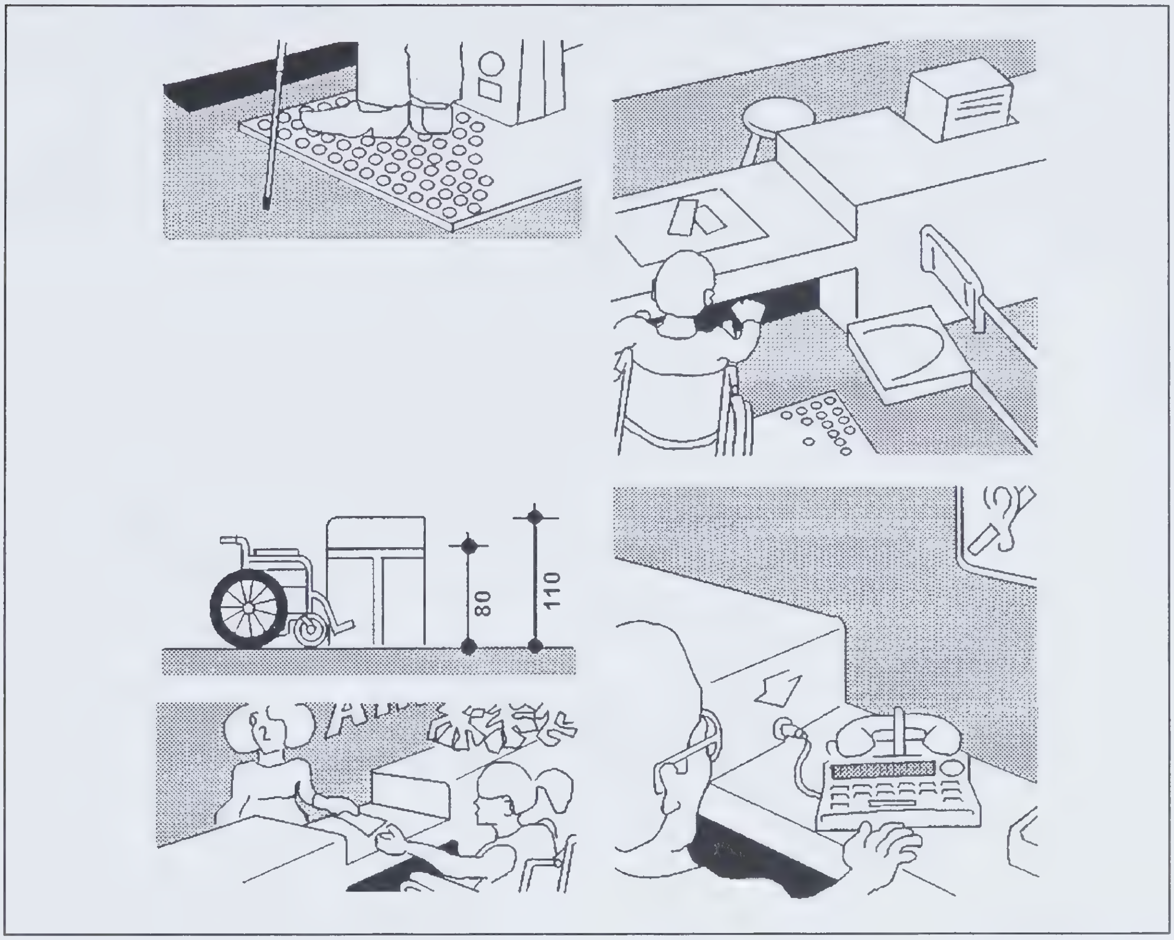
- No counter should exceed 110 cm in height, measured vertically from the floor surface (80-86 cm is preferred).

- Under all counters, there should be a clear space at least 90 cm wide by 20 cm deep (for knee clearance) by 76 cm high. It should have additional foot clearance measuring 23 cm high by 23 cm deep. Height dimensions should be measured vertically from the floor surface.
  Note: CSA standards allow a minimum clear space of 75 cm in width under lavatories. However, this is not sufficient for passengers with baggage at check-in counters.
- Where service counters exceed 86 cm in height, an auxiliary counter, offering the same services, should be located in the immediate vicinity. The second counter should have a height measuring less than 86 cm (80 cm preferred) and should serve customers who are unable to stand or who are much shorter than the average height.
- All queuing areas should be at least 92 cm wide.
- There should be a platform in the queuing area for customers to place baggage while they purchase tickets. The minimum platform dimensions should be 30 cm deep by 60 cm wide and between 65 cm and 86 cm high, measured vertically from the floor.
- Lighting at service counters should have minimum intensity of 200 lux.
- There should be no protruding, sharp, or abrasive surfaces under the counters.
- Cues for blind persons should be located in three places: on hand rails, floors, and walls.
- Functional furniture should serve additional needs. Ticket counters, for example, may also provide support for persons with disabilities.
- Emergency communication and information should be provided in rest and refuge areas.

3.4.3 Turnstiles and Gates

Turnstiles create obstructions, particularly for persons who are blind, and present barriers to natural pedestrian traffic flow. Avoid turnstiles wherever possible in terminal design.

Where turnstiles are necessary, a gate should be beside them for people carrying baggage or using mobility devices and strollers. The gate should have a minimum width of 81 cm and should be identified by the International Symbol of Accessibility.



(Dimensions in cm)

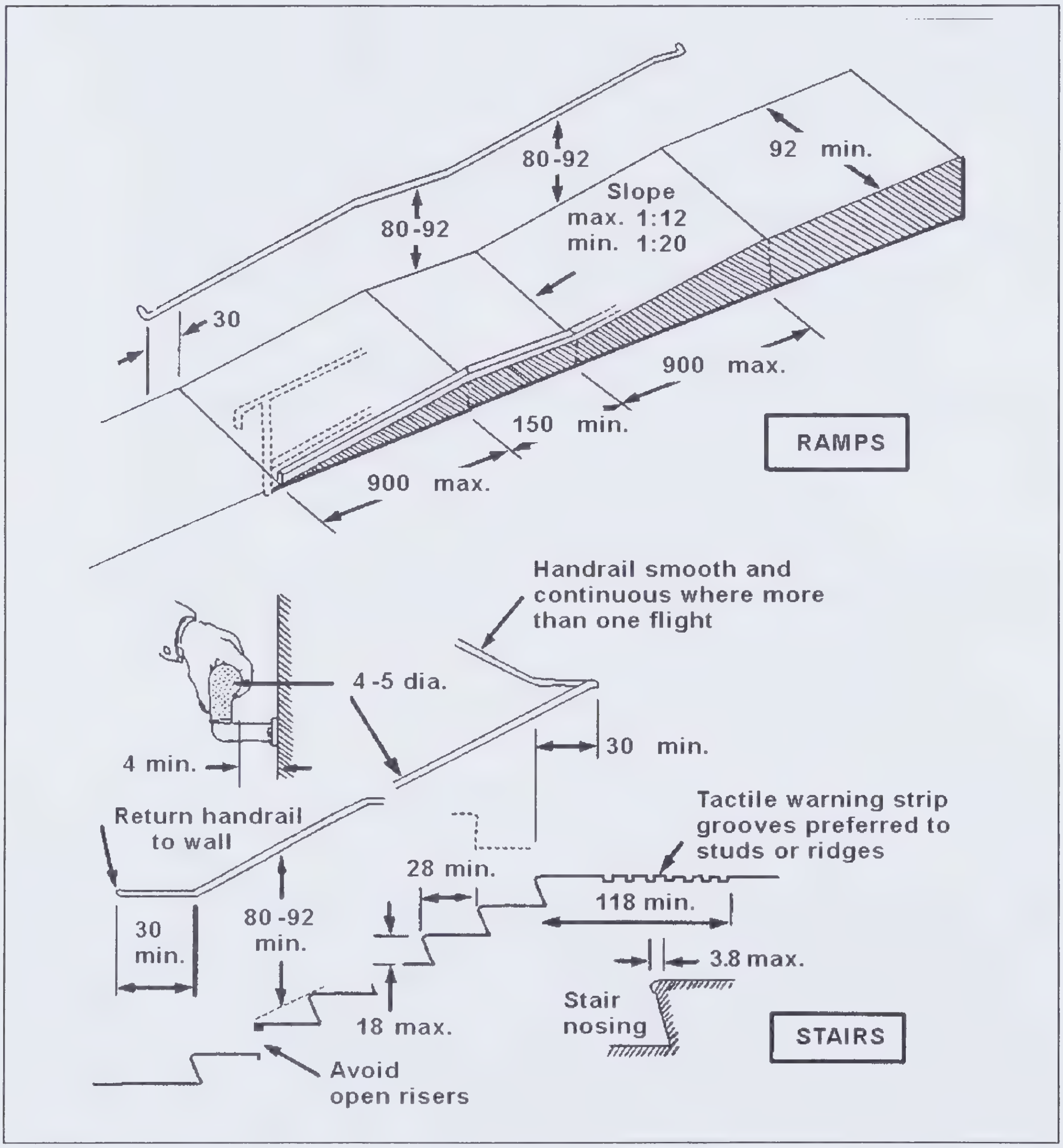
Figure 3.4 Graphic design guidelines for service counters – To illustrate counter heights and the use of tactile floor surfaces for air, bus, and rail terminals
(Rutenberg and Barber, 1982)

3.4.4 Ramps and Stairs

Figure 3.5 illustrates design features for ramps and stairs including handrails. The following guidelines apply:

- For grade changes exceeding one metre, steps and stairs should complement ramps or elevators.
- There should be level areas at least 1.5 m long at both the top and bottom of ramps and stairways.

- All stairways and step dimensions on a single site should be standardized.
- Outdoor stairs should be sheltered from rain, wind, and snow, and from accumulation of ice.
- Angular step risers are not permitted.
- Lighting for ramps and stairs should be carefully positioned since back lighting creates problems for visually impaired persons.



(Dimensions in cm)

Figure 3.5 Design for accessible ramps and stairways
(BC Transit, 1992)

3.4.5 Handrails (See Figure 3.5 and Section 8.8.7)

- The upper surface of all handrails should be between 80 cm and 92 cm (84 cm preferred), measured vertically from floor or ramp surfaces or from the outer edge of steps.
- Handrails should be round or have an equivalent oval cross-section, with diameters ranging from 3 cm to 4 cm, and be padded and colour coded (see Figure 3.5).
- Handrails on smooth walls should have a minimum clearance of 3.5 to 4.5 cm between the wall surface and the inner edge of the rail (6 cm is needed for rough wall surfaces).
- Unless a handrail is continuous, it should be extended for a distance of 45 cm beyond the top step of long stairways. Handrails should be extended a minimum 30 cm plus one tread-length at the bottom of all stairways.
- If children will use the passageway frequently, a second handrail should be placed at a height of 61 cm, measured vertically from the ramp surface or outer edge of steps.
- The projecting ends of handrails should not present a hazard. They should return smoothly to the wall, floor, or post.

3.4.6 Elevators

All elevators must meet or surpass the standards in CAN/CSA-B44-M94 *Safety Code for Elevators*. Other guidelines include the following:

- Level changes exceeding one metre should have elevators.
- All elevator cars should have a non-verbal emergency control system. (In some jurisdictions, this condition may be legally binding.) The control system should not be higher than 89 cm, measured vertically from the car floor. The system should be operable by pressing against it (see Appendix C of CSA-B651-95, *Barrier-Free Design*).
- Interior elevator control panels should be on sidewalls, accessible to people in wheelchairs, rather than on the front walls.
- Control buttons inside and outside the elevator car should include tactile symbols, be easy to push, and provide audible and visual feedback when activated. They should stand out from the control panel surface so that they can be activated with elbows and fists by people with limited strength in their fingers.
- Escalators, staircases, and elevators should be in the same general area.
- Elevator lobbies are waiting areas. Lobby designs, therefore, should include accessible seats, spaces for wheelchairs, waste receptacles, and tables upon which to rest baggage.

3.4.7 Escalators

Unless a site has serious structural barriers, moving ramps are preferable to escalators. All escalator specifications should meet or surpass the standards listed in Section 8 of CAN/CSA-B44-M94 noted above.

The *Transitway Station Accessibility Guidelines* manual (Delcan and Rutenberg, 1994) includes the following recommendations:

- The bottom and top landing areas should have a tactile pattern surface as well as a bright colour contrast.
- The step edges should have a bright coloured strip on the tread as well as on the riser.

3.4.8 Water Fountains

The following are recommendations for siting water fountains in terminals:

- Wall-mounted water fountains should have a knee clearance measuring at least 68 cm in height, measured vertically from the floor surface. Knee clearance should have a minimum depth of 20 cm. Foot clearance should be at least 23 cm high, measured vertically from the floor surface, and have a minimum depth of 43 cm.
- Water fountains may be wall mounted in an alcove. The alcove should measure a minimum 75 cm wide by 43 cm deep to give easy access to wheelchairs. A minimum clear space 1.2 m wide is required in front of the alcove. The minimum depth of the alcove plus the clear space is also 1.2 m.
- Free-standing water fountains are acceptable. These should not be recessed in an alcove since they must be approachable from the side to be accessible.

3.4.9 Washrooms

Washrooms must be made accessible in accordance with local building codes.

- Accessible toilet stalls should have grab bars at least 60 cm in length at the side and back. The rear bar should be horizontally centred over the toilet. They should be between 75 cm and 85 cm high, measured vertically from the floor surface.
- All accessories should be equipped with push-type controls.

3.4.10 Food Service Areas

Food service areas must be accessible in accordance with applicable building codes.

In planning self-service counters, designers should consider the reach limitations of wheelchair users. The maximum side reach is 50 cm, measured from the exterior side of the chair, at heights up to 120 cm. The maximum front reach is 50 cm, measured from the person's chest, at heights up to 110 cm (see Figure 3.6).

3.4.11 Furniture

Standards for furniture include:

- Rest area seats should have a minimum depth of 36 cm and a maximum depth of 42.5 cm.
- The minimum clearance width between armrests should be 52.5 cm.
- Furniture in terminals should be fixed or built-in. It should be placed either at right angles or parallel to walls and other furniture to reduce confusion in traffic flows, especially for persons who are blind. A majority of seats should face information boards, electronic displays, and concourses.
- In each seating area, a number of accessible seats should be reserved as priority seats for seniors and persons with disabilities. These seats should have arm and back rests, and a seat height of 45-50 cm.
- Other furniture should not have elements protruding above an average person's waistline.
- Waste receptacles should be recessed within walls.
- Standing waste receptacles with top openings are preferred to those with side openings.

3.4.12 Alarm Systems

Audible alarms should produce a sound level exceeding the prevailing sound level at the intended listener's ears by at least 15 decibels, or exceed by 5 decibels any maximum sound level lasting longer than 30 seconds. Alarm-signal sound levels should not exceed 120 decibels. Visual paging on a video screen should be provided in all areas, including washrooms, for persons who are deaf.

3.4.13 Cueing for Individuals with Impaired Vision

Recommendations for cueing aids include the following:

- A strip of colour measuring 10-15 cm in width should be placed at the junction of the floor and wall to help people with visual impairments. The colour should contrast distinctly with both the floor and the wall.
- Raised zebra markings should be used as traffic warnings.
- Floor plans should be based on square layouts, if possible.
- The location of fixtures and furniture should be predictable, to help persons who are blind to orient themselves more easily within the station.
- Non-glare fabric and surfaces should be used throughout the station.
- Control strips designed to influence crowd behaviour psychologically should be incorporated into the construction of major traffic corridors. These strips should be identifiable by their colour and textures. They could be used, for example, to indicate a more direct route rather than a slower, more protected route.
- Exits should be clearly identified for customers who are blind. Cueing for emergency exits, for example, must clearly differ from cueing for prohibited areas.
- Braille maps should be provided in areas where regional and station maps are located.
- Special attention should be paid to reducing confusing, reflected sound, especially on passenger platforms and in elevator lobbies.

3.4.14 Public Telephones

Telephone companies are knowledgeable about the installation of accessible telephone systems and should always be consulted. All telephones should be equipped in accordance with CAN3-T515-M85 (R1992) *Requirements for Handset Telephones Intended for Use by the Hard of Hearing*. Good practice includes the following:

- Telephones should not be located in noisy areas.
- Suspended telephone booths should not be installed in open areas.
- In terminals where telephones are not immediately visible, directional signs and/or pictograms should be posted to indicate telephone locations.
- At least one TTY/TDD should be provided in each bank of telephones. Use large symbols to indicate their locations in a terminal.

3.4.15 Printed Signs

The following should be considered:

- Type print should be lower case except to indicate proper names. Any necessary margin should be justified left.
- Less than 10 percent of people who are blind read Braille. Raised or recessed letters should therefore be incorporated into signs whenever possible. Ideally, letters should be large, measuring at least 1.5 cm in height. They should be raised or recessed a minimum of 1 mm from the surface of the sign.
- Signs should be made from translucent material with backlighting to minimize glare and reflection. Avoid the use of red lettering on black backgrounds.

3.4.16 Information Boards and Electronic Displays

Good design practice includes the following:

- An information board, including public transit routes/regional maps, should be conveniently located near the main terminal entrance/exit.
- In major stations, video screens should show gate arrival/departure information as well as general information. Every time the scheduled arrival/departure times or gates change, the new time or gate should flash on the screen for at least five minutes. Video displays should complement the public address system; all information should be available both audibly and visually.
- In all multiple-track rail terminals, each gate or platform access should bear information clearly identifying the track number together with the current train number, major destination, and departure time.

3.5 Human-Factors Information for Design

Travellers with physical, sensory, or cognitive disabilities have special needs when interacting with their environment. Effective design of controls and displays helps those with impairments to maximize their abilities. However, such devices are often designed without taking the special needs of disabled travellers into account.

People with disabilities are accustomed to accommodating to their environment or inventing ways around it. They need devices that either can be used with their limited abilities or can be modified. With good planning, most devices can be designed to accommodate such individuals. Human-factors guidelines are intended to promote good design practice and to offer a variety of effective approaches to each design requirement.

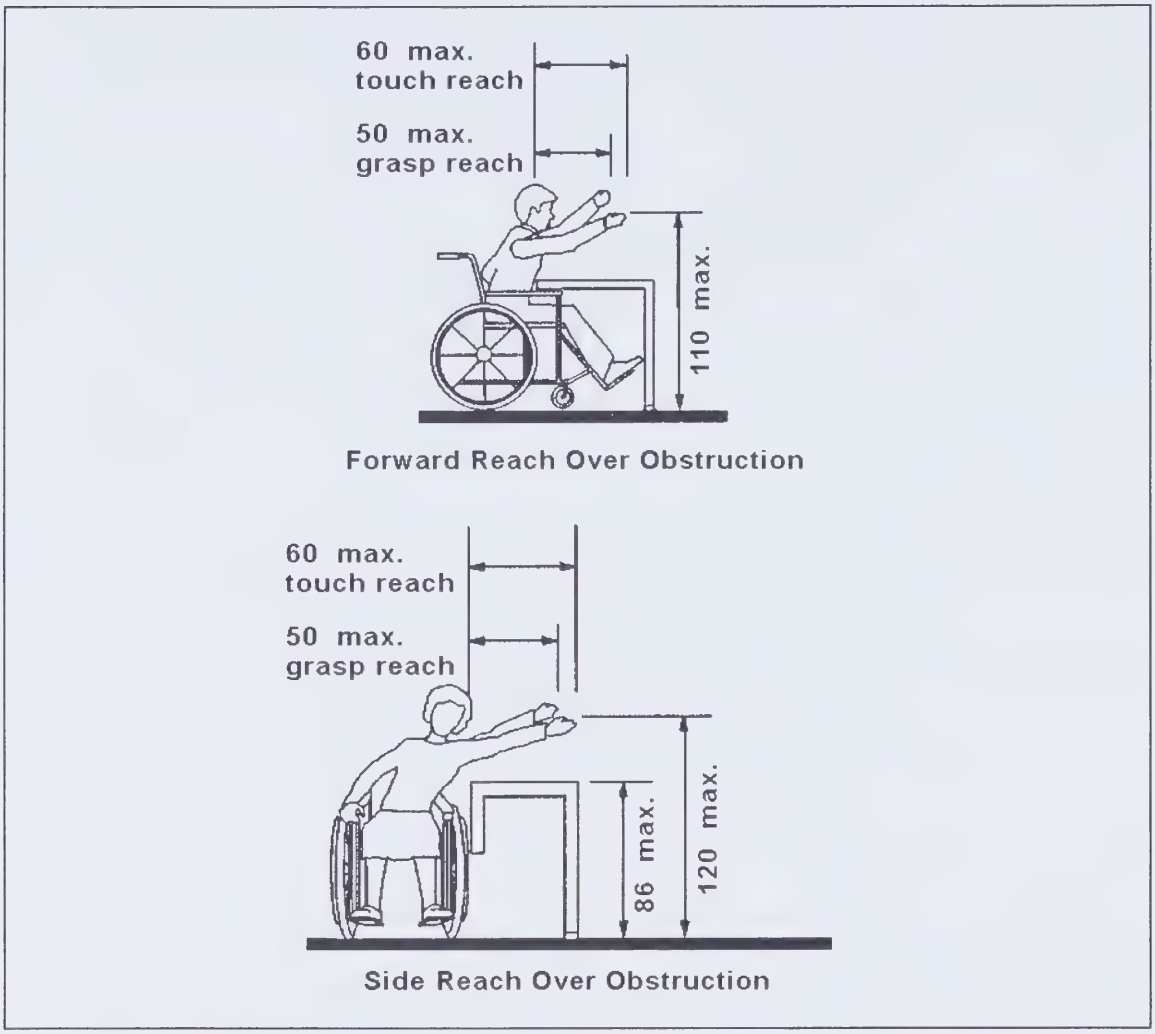
Mobility devices can be made user friendly for seniors and those with disabilities by applying good human-factors design principles and not limiting the device to a specific user. Other equipment designed for easy access by persons with disabilities can also be helpful, and often preferable, for people without disabilities.

The Canadian Standards Association has published standards that take human factors into account for those who design transportation products and services for travellers with disabilities. The CSA publications provide a level of detail not possible in this guide and often include helpful comments and suggestions for designers. Table 3.2 presents a summary of typical data required for pedestrian access planning and design. Figure 3.6 illustrates the typical reach distances for a person seated in a wheelchair.

Table 3.2 Typical specifications for pedestrian access

Feature		Recommendation
Alarms:	audible	1 Hz frequency
Doors:	clear opening	minimum 81 cm
	manoeuvring space	varies by type of door
Free-standing objects		maximum protrusion 30 cm between 68 and 198 cm
Gratings		maximum opening width 1.3 cm
Handrail extensions		minimum 30 cm
Illumination		minimum 100 lux
Pathways:	exterior	120 cm; 150 cm if two-way
	interior	minimum width 92 cm
	slope	maximum slope 1:20
Ramps:	slope	maximum slope 1:12
	landings	maximum between landings 9 m
Parking space:	vehicle space	minimum 240 cm wide
	aisle space	minimum 150 cm wide
Protrusions:	walls	maximum 10 cm
	free-standing objects	maximum 30 cm
Wheelchair access:	floor space	minimum 75 cm x 120 cm
	knee clearance	minimum height 68 cm
	viewing space	minimum 85 cm x 120 cm
	turning space	minimum 120 cm x 120 cm
	thresholds	maximum 1.3 cm
	refuges	two at minimum of 85 x 120 cm
Vertical clearances		minimum 198 cm
Warning surfaces		minimum length 90 cm

(CAN/CSA-B651-95)



(Dimensions in cm)

Figure 3.6 **Typical reach distances for a person in a wheelchair**
(Canadian Standards Association)

– 4 –

PERSONAL VEHICLES

- 1 - INTRODUCTION

CUSTOMER ACCESS

- 2 - TRIP PLANNING	- 3 - ROADWAYS & TERMINALS	**- 4 - PERSONAL VEHICLES**

SYSTEM ACCESSIBILITY

- 5 - COMMUNICATIONS SYSTEMS	- 6 - SAFETY & RELIABILITY	- 7 - TRAINING	- 8 - RESEARCH & DEVELOPMENT

PUBLIC CARRIERS: LOCAL

- 9 - ACCESSIBLE TAXIS	- 10 - URBAN BUS SYSTEMS	- 11 - URBAN RAIL SYSTEMS	- 12 - RURAL SYSTEMS

PUBLIC CARRIERS: INTERCITY

- 13 - AIR TRANSPORT SYSTEMS	- 14 - INTERCITY RAIL SYSTEMS	- 15 - INTERCITY BUS SYSTEMS	- 16 - MARINE SYSTEMS

- 17 - MODAL INTEGRATION

Related Information: The design of parking to facilitate access to transportation terminals is discussed in Chapter 3. Road safety issues are discussed in Chapter 6.

4 Personal Vehicles

Personal motor vehicles compete with and complement public transportation carriers for travellers with disabilities. For those who can drive, personal vehicles provide independence and access to other transportation modes. Such vehicles are used in 88.7 percent of all trips over 80 km by persons with disabilities (Goss Gilroy, 1995a).

Approximately 87 percent of persons with disabilities use private motor vehicles as a passenger; 55 percent (approximately 2.1 million persons) drive themselves. The automotive options or features most commonly selected by persons with disabilities include power steering, power windows, and power mirrors. Special features such as hand controls for acceleration and braking, wheelchair ramps or lifts, and/or space for a wheelchair or other special equipment (including storage space) are used by 46,000 persons with disabilities when driving a personal vehicle.

Ease of access to transportation terminals by motor vehicle drivers and passengers is an important factor in choosing how to travel. The availability of accessible parking, pick-up and drop-off facilities, and good directions are factors determining whether travellers will use public transport for parts of their trips.

The changes forecast in the Canadian demographics will have significant effects on the use of personal vehicles in the future:

- Seniors and persons with disabilities are taking more trips (Toronto Transit Commission, 1989).
- Two out of three Canadians aged 65 years and over say they have no long-term activity limitations. However, 9 percent of seniors aged 65-74 years report that their vision limits their activities, and 21 percent say they are restricted by hearing impairment (Statistics Canada, 1992).
- The use of automobiles by the general population is growing faster than the population (Statistics Canada, 1995).
- Whereas in the past retired women depended largely on public transportation, most women who retire in the future will use personal vehicles (Statistics Canada, 1995).

4.1 Accessibility Issues

The major accessibility issues include the following:

- educating, assessing, and licensing drivers with disabilities;
- adapting personal motor vehicles to meet the needs of drivers with disabilities;
- re-examining older drivers and those with reduced ability to operate motor vehicles safely;
- providing accessible reserved parking for drivers with disabilities.

While tens of thousands of persons with severe physical disabilities operate personal vehicles safely, assessment of the ability of seniors and persons with cognitive disabilities to drive or to be successfully trained to drive a motor vehicle is a concern for licensing agencies and insurance companies. Such individuals often do not have the ability to process and coordinate sensory, perceptual, and cognitive events at the level essential for safe driving (Heron, 1992).

To address these issues, two workshops on assistance for drivers with disabilities were convened with the help of the Transportation Development Centre (TDC), one in 1992 and another in 1995. The workshops addressed topics such as safety and fairness in evaluating clients, standardized driver competency measures, dementia and driving, the results of a cross-Canada survey of driver rehabilitation programs, the use of technology in driver rehabilitation and assessment, and the assessment of appropriate vehicles for drivers with disabilities (McInerney, 1992; Geehan, 1995a).

Driving simulators are often used for training and testing drivers. Research has been undertaken to develop better simulation equipment for evaluating the cognitive abilities of drivers. Of particular interest is the ability of a driver to handle multiple tasks and the speed of a driver's response to external information.

Other issues of interest to drivers with disabilities include the process of issuing permits to use reserved parking spaces and the accessibility of pathways between the reserved parking spaces and the related activity centres.

4.2 Regulation

The Canada Motor Vehicle Safety Standards (CMVSS) ensure that new motor vehicles manufactured in or imported into Canada meet minimum vehicle safety and environment protection criteria. The Road Safety and Motor Vehicle Regulation Directorate of Transport Canada enforces the CMVSS provisions.

Original equipment manufacturers are responsible for ensuring that their products are safe. This responsibility includes a requirement to recall the vehicle for up to five years to correct any defective components that affect safety. When significant modifications are made to the stock vehicle, the secondary equipment manufacturer must certify that the modified vehicle meets the required safety standards and must be responsible for any recalls due to the modifications (Goss Gilroy, 1996).

4.2.1 Provincial Licensing Policies and Procedures

The licensing of all drivers, including those with disabilities, is under provincial jurisdiction in Canada. In 1990, TDC sponsored a review of provincial driver-

licensing procedures across Canada. The review found that, except in Ontario, provincial and territorial licensing agencies did not automatically apply age-based re-examination. Most jurisdictions required evidence of medical fitness from older seniors and from persons with obvious disabilities. The standard procedure of involving physicians, rehabilitation agencies, and driver educators appears satisfactory in most major Canadian cities. Some jurisdictions reported very low demands on their licensing agencies. Other provincial agencies indicate that funding constraints are causing backlogs in driver evaluations.

Table 4.1 presents a synthesis of the major features of the provincial and territorial licensing procedures in 1990, including the availability of driver evaluations and training; the age at which medical evidence of fitness to drive is required; and unique features of each jurisdiction. A detailed description of the procedures is included in the TDC report (Rutenberg and Atkinson, 1990). Two features apply to all jurisdictions:

- The only standard to have been adopted uniformly across the country is for a minimum level of visual acuity (20/40 in one eye, aided or unaided, for a licence to drive automobiles or light trucks). A restricted licence may be obtained by an applicant with visual acuity of not less than 20/60 in one eye, aided or unaided.
- All licensing agencies require the application of medical standards to evaluate drivers of any age where disabilities may be contributing to poor driving habits. The need for such evaluations often becomes apparent from sources such as accident records, complaint files, and police reports.

4.2.2 Driver Assessment and Education

Persons with disabilities who wish to drive a motor vehicle face several hurdles that can delay their being licensed to drive. Rehabilitation hospitals and other supportive services provide assistance related to the following:

- **Clinical assessment:** A comprehensive evaluation of the applicant's potential to drive an automobile, either for the first time or following a disabling or debilitating accident or illness. It usually includes a review of medical and driving history, an assessment of physical/functional status, and a visual/perceptive/cognitive screening conducted by an occupational therapist. A driving simulator may be used in the evaluation.
- **Driving instruction:** An on-road performance assessment of the applicant in an actual driving environment using a vehicle with equipment similar to that needed by the applicant. Training may be recommended to assist the applicant to compensate for a disability or to teach the client how to use adaptive driving equipment. Driving instructors usually work closely with the clinical evaluator.

- **Vehicle modification:** Specialists in installing adaptive driving equipment and modifying vehicles are part of the process of training a person with a disability to drive.

Table 4.1 Provincial and territorial licensing policies for drivers with disabilities

Province or Territory	Driver Evaluation	Driver Training	Medical Required	Features and Needs
Alberta	Yes	Yes	Ages 75, 80, 82	1, 3
British Columbia	Yes	Yes	Ages 75, 80, 82	2
Manitoba	Yes	No	Discretionary	2
New Brunswick	Yes	Yes	Discretionary	1, 4, 5
Newfoundland and Labrador	No	No	Ages 70, 72	1, 5, 9
Northwest Territories	No	No	Ages 70, 72	1, 6, 9
Nova Scotia	Yes	Yes	Discretionary	1
Ontario	Yes	Yes	Ages 80, 81	2, 7
Prince Edward Island	Yes	Yes	Discretionary	2
Quebec	Yes	Yes	Ages 70, 72	1, 8, 10
Saskatchewan	Yes	Yes	Discretionary	1, 8
Yukon Territory	Yes	No	Ages 70, 72	1

1 Legal responsibility for reporting disabilities rests with the individual.
2 Legal responsibility for reporting disabilities rests with the medical profession.
3 Driver-training costs are covered by Alberta Health Care Insurance.
4 Lifetime driver's licence is issued.
5 Vision tests may be insufficient.
6 Driver evaluations are referred to an Edmonton facility.
7 Compulsory re-examination is required at age 80.
8 Public insurance agencies are involved in the process.
9 Annual medical is required from age 80.
10 Renewal applicants need not appear in person.

Once the clinical assessment is complete, most clients are referred for in-vehicle instruction and assessment of equipment needs. Certain issues are addressed:

- Should drivers be trained to a minimum acceptable level, or should they undertake further effort and expense to attain a higher level of proficiency to provide a safety buffer?
- Should instruction focus only on disability-related issues or should it extend to correcting poor driving habits?

Safe driving includes the ability to perceive risk and handle emergency situations. When evaluating the implications of a driving error, it is important to consider both what the driver did and why this was done, with the latter having the strongest implication for safety evaluation.

In the course of driving instruction, it may become apparent that the applicant is not making progress and is unlikely to become proficient enough to drive. At some point, the driving instructor must decide to discontinue lessons. Three to five lessons are generally enough to estimate the potential for improvement. One province requires that a client be provided two to four lessons to determine potential. It may be tempting for instructors to continue even if there is little chance of success; therefore, a predetermined criterion for terminating instruction is useful. Some allowances must be made for individual differences in setting a cut-off point.

Most evaluation and instruction take place in vehicles furnished by service providers. The following guidelines apply:

- Initial assessments should be carried out in the client's vehicle only if it is equipped with dual brake controls.
- Training in the client's vehicle may be acceptable once a client has undergone initial instruction, and the instructor has confidence in the capabilities of the driver.
- Assessment vehicles generally have one type of hand-control system, a right-angle push type. This type of control has several advantages: it is flexible enough to meet most drivers needs, and it is easiest to adjust and replace.

4.3 Reserved Parking for Persons with Disabilities

Parking spaces for persons with disabilities are typically determined as a percentage of the total parking available, regardless of the type of facility. This method ignores the fact that people with disabilities have more need of parking spaces at some facilities than at others.

A TDC-sponsored project developed recommended rates for parking for persons with disabilities (Noxon and Gravel, 1992). The recommendations are shown in Table 4.2.

The recommended rates are intended to help Canadian municipalities govern the supply and control of parking for persons with disabilities.

Table 4.2 Recommended rate of parking spaces for persons with disabilities

Facility	Parking Spaces
Shopping centres	
Less than 30,000 m^2 gross floor area (GFA):	1.09 spaces/1,000 m^2 GFA; min. 1 space
30,000 to 45,000 m^2 GFA:	Application of previous or following rate, depending on characteristics of facility
Greater than 45,000 m^2 GFA:	0.44 spaces/1,000 m^2 GFA
General office buildings	0.42 spaces/1,000 m^2 GFA; min. 1 space
General hospitals	0.02 spaces/bed; min. 1 space
Medical offices or out-patient treatment centres	1.0 space/1,000 m^2 GFA; min. 1 space
Restaurants (fast-food or sit-down)	3.2 spaces/1,000 m^2 GFA; min. 1 space
Hotels	0.02 spaces/guest room; min. 1 space
Mixed-use off-street public parking	
New facilities	1.5% of facility's total parking capacity; min. 1 space
Existing facilities	1.5% of peak regular parking demand; min. 1 space
On-street public parking	2.5% of district's total on-street parking capacity (e.g., downtown core)

(Noxon and Gravel, 1992)

4.4 Vehicle Adaptation Technology

Most vehicles can be fitted with special equipment, but some models are costly to adapt. Before choosing a particular model, the buyer should consult a driver educator and a reputable adapter to find out whether the model is difficult to adapt. This is particularly important if cost is a key consideration. Driver educators usually work closely with vehicle adapters to ensure that the adaptations suit a driver's needs.

The following guidelines are an updated version of those in a buyer's guide produced for TDC in 1986 (J.F. Hickling Management, 1986; Fiander, 1990).

4.4.1 Vehicle Selection Options

Although larger cars, in general, may appear to afford roomier interiors, a smaller car's advantages may make it a more attractive purchase for many persons with disabilities. Only a personal inspection will allow a buyer to determine the best size. The following are important options:

- **Automatic transmission:** For many drivers with disabilities, an automatic transmission may be a necessity. In most cases, it is highly desirable.
- **Power steering and brakes:** Most drivers with disabilities should seriously consider both of these features. They reduce the exertion required to drive. Power steering is important at low speeds when turning the steering wheel can be difficult.

A prospective buyer should take into account:

- external visibility from inside the vehicle
- visibility of the instrument panel
- door-entry widths
- effort required to open and close doors
- door-sill heights and footwell depths
- room for mobility equipment behind the front seat or in the trunk
- obstacles such as transmission tunnels, consoles, and shift controls
- seat configurations and seat belts
- trunk characteristics and volume
- appropriate adjustment range of seat and steering wheel

and then consider the following features:

- power windows
- power seats
- adjustable steering wheel
- cruise control
- air conditioning
- trunk release
- power door locks
- seat-angle adjustment
- lumbar support

Vans with a large wheelbase (350 cm) are considered more adaptable for driving either from a wheelchair or from the van's power seat. A short wheelbase (315 cm) may be less expensive, but it also provides less room for wheelchair manoeuvrability, and less passenger and storage space. The location of the gas tank in the short wheelbase van interferes with the wheelchair driver's power pan. *Neither dual gas tanks nor auxiliary heaters should be factory ordered unless first cleared with a professional van modifier.*

All full-sized vans and most models of mini vans can be adapted for drivers with disabilities. In some cases it is feasible to lower the floor in a mini van; in others the roof must be raised. The following examples show adaptability potential:

Mini Van	Raise Roof	Lower Floor
Chrysler	X	X
Ford Aerostar	X	
GMC Astro/Safari	X	X
GMC Jimmy (Elaine Anne Lift)		X
Lumina (rear entry only)		X

Table 4.3 illustrates the cost of the most common options and modifications required to accommodate various types of disabilities. Table 4.4 lists recommended equipment options for van adaptations.

4.4.2 Adaptive Equipment

Entry and Exit Technology

- **Adapted key holders:** A variety of auxiliary key holders accommodate various limitations in the use of the fingers or hands.
- **Wheelchair lifts (electric, gravity, or hydraulic):** These can be automatic or semi-automatic and operate using a folded platform. Size and weight of the wheelchair are important considerations.
- **Car-top wheelchair loaders:** These automatically fold and store a conventional wheelchair under a weather-resistant cover on top of the automobile.
- **Wheelchair loader (in car):** Installed on either the passenger or driver side of any full-sized two-door automobile. A switch activates the loader, which lifts and stores the chair behind the driver's seat.
- **Trunk loader:** Consists of an electric hoist attached to the automobile bumper. It can be used to load a powered scooter or a wheelchair. Manual loaders are also available.

- **Bumper rack loader:** Fits onto the rear of the trunk and can be either hand or power operated. (The traveller must be able to walk from the rear of the automobile to the door.)
- **Automatic door opener:** Available for vans with sliding or swing doors; consists of separate switches in a control box (or a single key holder for sequential operations). For those unable to manipulate keys, remote control or magnetically activated switches are available.
- **Transfer assists:** For persons unable to transfer easily on their own, a variety of transfer assists are available (transfer boards or overhead handle above the doorway).
- **Sliding rear door:** For four-door vehicles, to allow self loading of wheelchairs.
- **Wheelchair ramps:** Portable ramps for vans with two or three steps.

Seating Equipment and Restraints

- **Torso restraints:** When driving a van from a wheelchair, a chest harness and/or lateral trunk support may be used, together with lap belts, for those with diminished trunk musculature and balance.
- **Power driving seat:** A four- or six-way power-seat base (front to rear travel, vertical travel for height adjustment, and swivel) facilitates a driver's self-transfer from a wheelchair to the driver's seat and allows for optimal positioning for driving.
- **Power pan:** Designed to accommodate the driver with a disability who cannot transfer from a wheelchair to a seat without assistance and who must drive from a wheelchair. This allows drivers to lower the line of vision 6-15 cm by lowering the vehicle floor in the driver's area.
- **Power wheelchair securement:** Quick lock-and-release system for the wheelchair enables the driver with a disability to quickly and easily secure a wheelchair in the proper driving position.
- **Manual wheelchair securement:** Used by a driver or a passenger who can operate a wheelchair securement device manually.
- **Wheel wells:** These channels are installed in a vehicle floor to lower the wheelchair driver, thereby correcting visibility problems caused by height.
- **Removable seat base:** This is a detachable seat, usually mounted on casters. It allows for easy conversion of the driver's station for a wheelchair driver. Stored in the rear of the van when not in use.
- **Pivoting seats:** For easy access by drivers.

Table 4.3 Typical costs for vehicle adaptation options (labour hours and material charges)

Item	Est. Cost (1990 $)	
	Hours	Material
Lower van floor 15 cm (for increased head room)		5,155
Hydraulic lift with split platform (to swing out of way to allow access)	6.0	3,985
Key-activated door and external lift control	7.5	1,230
Back bench with fabric upholstery and seat belts	1.5	825
Removable electric driver seat with armrests	3.0	1,890
Passenger seat that will pivot manually	0.5	65
Fabric upholstery on seats	1.0	475
Wheelchair stabilizer	1.5	395
Driver position manual wheelchair securement and power head rest	6.0	2,080
Wheelchair securement	3.0	835
Back-up systems on steering and brakes		4,360
Horizontal steering with straight head		7,220
Push/pull hand control interchangeable from right to left side with removable quad grip	4.0	775
Vertical push/pull hand control	5.0	1,520
Vacuum hand control		6,905
Parking brake extension	0.5	75
Dual brakes	3.0	295
Left gas pedal (removable)	0.5	95
Relocation of wiper/washer, horn, dimmer at elbow level (adjustable and removable)	6.0	420
Flasher extension	0.5	65
Gear-shift extension	0.5	95
Palm grip		110
V-grip		115

(Fiander, 1990)

Table 4.4 Adaptive equipment options for vans

Function	Options
Access and ignition	Remote control, special key device, or keyless for entry
Lift	Fold out platform; rotary or swing type
Ramp	Powered or manual (aluminum)
Door(s)	Slide or swing under power (raised for headroom)
Roof	Reinforcement cage, raised and finished inside
Walls	Insulation
Flooring	Add plywood for smoothness, and non-slip carpeting
Steering	Tilt, extended, and offset if necessary; powered with low/no effort backup
Braking	Extended pedals or hand controls with angle, twist, or push/pull or servo action

(Bowen and Young, 1995)

Steering Aids

- **Steering column extension:** Brings the steering wheel 5-15 cm closer to the wheelchair driver. Provides extra leg room and compensates for reduced range of movement.
- **Foot steering control:** Transfers control of hand-operated driving functions to foot operation. Auxiliary and secondary vehicle controls are adapted to foot operation.
- **Low-effort steering:** Reduces vehicle steering effort by about 40 percent.
- **Zero-effort steering:** Reduces steering effort by approximately 70 percent; a back-up steering system is usually recommended. Available for cars or vans with power steering.
- **Horizontal steering column:** Motorized, telescoping steering column allows for adjustment of steering in a variety of planes and positions. It adapts to the reach limitations of a driver and can be positioned for right- or left-hand use.
- **Deep-dish steering wheel:** Brings the steering wheel rim approximately 10 cm closer to the wheelchair driver and is normally used with a low-effort steering system. It improves accessibility to the steering wheel for a driver in a wheelchair and lessens the range of steering motion.

- **One-hand drive control system:** Designed for persons with limited or no use of lower extremities, but with good strength in one arm and hand. Its main component is a knob through which steering, brake, and throttle are activated. Auxiliary switches can be located adjacent to the knob with toggle switches for convenience.
- **Steering spinners:** Permit safe operation of the steering wheel by drivers who must steer with one hand, allowing them to remain in contact with the steering wheel at all times. They come in a variety of configurations, including an amputee ring, a knob, a so-called "quad steering cuff", a palm grip, a tri-pin, and a v-grip.

Acceleration and Braking Controls

- **Hand controls:** Push-pull, twist-push, and right-angle push (also known as the universal control because it can be used for most disabilities). These are recommended for use in vehicles with power brakes and steering; they do not interfere with operation of the vehicle by most drivers.
- **Quad hand control:** An extra L-shaped attachment for hand control. It is designed for quadriplegic drivers with little wrist or hand strength. It is used with a dimmer switch and horn button.
- **Hand clutch control:** For vehicles with standard transmission. This is recommended for drivers with weakness in or loss of use of the left leg only.
- **Left-foot accelerator pedal:** Accelerator functions of the vehicle are converted to left-foot use for those with limited or no use of the right foot.
- **Pedal extensions:** Used when a driver's legs are too short to reach the gas and brake pedals. They must be light enough not to depress the pedals unless activated, and secure enough not to slip off while the car is being driven. They are often used together with a false floor on which to rest the driver's heels.
- **Parking brake extension lever:** Attaches to a foot-operated parking brake to adapt it to hand use. The driver still needs a grip sufficient to operate the regular brake and lever.
- **Servo controls:** Touch controls that provide reduced-effort acceleration and/or braking control. Two levels of assistance are available: low effort or zero effort. Emergency back-up systems are available to provide additional safety in case of control failure.
- **Electric parking brake:** Offers complete control of the power brake by manipulation of a toggle switch. It is available for cars, vans, and trucks, and is usually prescribed for individuals who drive a van from a wheelchair.

Vehicle Operating Controls

- **Portable hand controls:** Used on a *temporary basis* only. Very strong arms are required. For use in rental cars on which hand controls are not available (CSA , 1994b).

- **Right-hand directional signal extension lever:** Attaches to the turn-signal lever and crosses to the right side of the steering column for persons unable to use their left hand.
- **Left-hand gear selector extension lever:** Attaches to the gear-shift lever and crosses to the left side of the steering column. For use only on vehicles with automatic transmission.
- **Gear-selector extension lever:** Provides more leverage for people who have difficulty selecting gears. Used with automatic transmission only.
- **Powered gear selector:** Allows a driver with an upper extremity dysfunction to shift gears with a toggle switch positioned where it is most convenient for the driver (usually on the console).
- **Remote wiper/washer, horn, dimmer switch, directional signals, and headlights control:** Relocates these functions to an easily reached location, allowing the driver to use a switch with the hand, elbow, head, or knee, whichever is most convenient.
- **Quad control:** Provides a hand location for all accessory controls and out-of-reach switches normally found on the dash.
- **Keyless ignition:** A toggle switch provides remote control of ignition for drivers unable to manipulate an ignition key.

4.5 Accessibility Planning Guidelines

For more information on this topic consult:

- Section 3.3 for pedestrian accessibility, and Section 3.5 for human factors;
- Section 5.2 for communications media and technology;
- Section 17.2 for multimodal travel planning;
- Canadian Standards Association CAN/CSA-B651-95 on *Barrier-Free Design* for access to terminals;
- Provincial and territorial insurance and licensing agencies;
- Driver-education programs provided by rehabilitation hospitals such as the Hugh MacMillan Rehabilitation Centre in Toronto;
- The occupational therapy departments of regional hospitals;
- Local vehicle adapters;
- Local municipal officials regarding traffic safety;
- Commercial driver educators;
- The National Mobility Equipment Dealers Association;
- The Road Safety Educators Association;
- The Canadian Automobile Association.

Easy access to transportation terminals for personal vehicle drivers with disabilities depends on several factors:

- Early consultation with local traffic authorities regarding traffic access and traffic and parking regulation, standards, controls, and enforcement;
- Grade separations between pedestrian traffic and vehicular traffic whenever possible;
- Adequate numbers of reserved close-in parking spaces for people with disabilities (see Table 4.2);
- Good maintenance and snow clearing of parking areas and pathways to the terminal;
- A central registry system (single point-of-entry) for issuing parking permits and vehicle identification materials to people with reserved parking spaces;
- Accessible, easily read instructions on parking validation machines and meters.

– 5 –

COMMUNICATIONS SYSTEMS

– 1 – INTRODUCTION

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Related Information: Guidelines for the placement of communications systems are provided in Chapter 3. Systems unique to a particular mode are discussed in the chapter on that mode.

5 Communications Systems

To market their services successfully, public transportation systems must convey substantial amounts of information to their customers. Such information should be easily understood by both regular and occasional customers with varying physical and cognitive abilities. The process of conveying information to customers is often interactive; hence, the term "communications" is commonly used. Customers need several types of information:

- pre-trip planning information, including sources of planning information and assistance, services offered, rules and regulations, schedules, the days that service is offered, travel times, routings, connecting carriers, and instructions for access;
- layout of terminal and roads, including location of designated parking areas; accessible external pathways and entrances; internal pathways; information, ticketing, and check-in counters; and baggage-claim areas; as well as information on boarding procedures and departure times;
- in-vehicle information, including emergency procedures, on-board services, and deboarding procedures for initial and connecting carriers.

Travellers need adequate, correct information in a format that they can understand to make the right decisions to reach their destination. This information should be available at the point where decisions are made. If one of these elements is missing, travellers will have problems using the transportation system.

Access to information at any time while travelling is vital if customers are to have a complete awareness and understanding of the transportation system.

5.1 Communications Needs and Issues

Information must be transmitted in an easily understood format to all categories of travellers. The main points are:

- **Information availability** tells the traveller where, when, and how to obtain information.
- **Service availability** helps the user to find the desired network and routings.
- **Access directories** help the user to find the desired terminals, network, and routings.
- **Instructions for use** provide information about how to use the system (route, time, price).
- **Rules and regulations** convey information on the scope and limitations of the service (baggage allowance, smoking areas).

- **Special services** provide customer-service information about special fares and popular destinations, for example.
- **Timetable data** identify departure and arrival times, estimated duration of the trip, routing, vehicles used, and transfer connections.
- **Fare structures/classes** define fare structures as a function of the class of service, destination, distance travelled, and duration of the trip.
- **Reservations and payment** involve the purchase and validation of tickets, with information about type and location of ticket sale and methods of payment.
- **Boarding times/locations** provide vehicle departure times from specified locations.
- **Orientation in terminal** identifies check-in counters, departure gates, and baggage-claim areas inside the terminal.
- **Boarding procedures** designate vehicle departure procedures from specified locations.
- **Emergency procedures** advise travellers of procedures in the event of an emergency situation and explain the use of technical devices when they are to be used by the travellers themselves.
- **Warnings and prohibitions** refer to dangers related to the operation of the vehicle and protect the operator from misuse of the equipment.

Travellers depend on a variety of information to help orient themselves and to find their way around in unfamiliar surroundings such as terminals.

Studies sponsored by the Transportation Development Centre (TDC) of Transport Canada have shown that travellers with visual, hearing, or cognitive disabilities need clear, adequate signs to help them find their way around terminals (Geehan and Wallersteiner, 1989). Although inadequate signs may be blamed for confusion in passenger terminals, they are only one aspect of the problem. People are also a vital source of information, and the layout and facilities of the building itself can be helpful as well. For example, stairs or elevators communicate the way to other levels without using signs at all. Even the best signs cannot solve the problems of a badly designed facility, which may create an environment that conveys too much information; the resulting clutter can mask the essential information.

Travellers with disabilities or communication difficulties may depend on one of two strategies for orientation and wayfinding – sequential or spatial (cognitive mapping). Both are equally important.

Travellers, particularly those with visual or cognitive disabilities who are unfamiliar with a facility, typically use a sequential strategy for wayfinding. For example, a visually impaired person may be able to get from a specific entrance of a terminal to a ticket counter by following a memorized route without knowing the overall spatial relationship of the terminal. This sequential strategy emphasizes a string of landmarks and does not rely on the relationship between them.

Other travellers may depend heavily on their mental image of the environment – their cognitive map – and on whatever landmarks and cues are useful to them. A cognitive map is a "mental road map" that provides a spatial understanding. Unlike a printed road map, it is unique to each person. Strategies for developing and using cognitive maps vary from person to person.

Using both a sequential strategy and a more integrated cognitive mapping strategy gives a person greater flexibility. First-time users of a terminal may find sequential wayfinding easiest. Terminal designers can provide for this by installing clear signs and landmarks such as activity points. Travellers who are more familiar with the setting may find integrated cognitive maps more helpful. Designers can provide for this by using tactile and visual graphics and creating simple circulation patterns that feature textured paths.

The information that people obtain from their surroundings is called environmental communications. Everything that can be imparted by a particular setting falls into one of three types of environmental communications (Arthur and Passini, 1990): information about the setting, directions to destinations, and identification of destinations. The particular settings at which travellers need communication from their environment may include reference points, decision points, and destination points.

Table 5.1 shows how environmental communications help to identify, inform, direct, warn, or regulate travellers. The most important forms of environmental communication are verbal information services; graphic information (signs, symbols, directories, maps); architectural cues (entrances, stairs, elevators, doors, textures, sound); and spatial perceptions (how things relate spatially to each other).

5.2 Communications Systems Technology

Communications systems used by transportation carriers include the following features:

- Fixed signs are the most frequently used and least expensive way to transmit information.
- Fixed transparencies are a more expensive form of sign that attract more attention; if illuminated, they are especially effective in dark areas and at night.
- Variable message signs are often used for frequently changing information. They are indispensable for remote data transmission.
- Public address systems provide amplification, dissemination, and remote transmission of voice and other acoustical signals.
- Audio terminals (such as telephones) provide a means of transmitting human or synthesized voice information from a distance.

- Printer terminals can constantly or intermittently transmit current status information or requested information via print-outs.
- Digital displays are a more interactive form of variable message sign as they give the user simple listings.
- Video displays can constantly transmit complex information remotely via video display units, either actively or interactively.
- Multimedia terminals transmit written, visual, and audio information interactively.
- Information kiosks are staffed by trained transportation agents who can answer travellers' questions.

Table 5.1 Basic types of environmental communication

Information Type	Description	Examples
Information about the setting ?	Information showing destinations and visitor location in the setting Hours of service Dos and don'ts Warnings	Maps, exploded views, plans (at entrance points) Directory (beside maps) Signs (beside doors) Regulatory signs (as appropriate)
Directions to destinations →	Information to guide visitors	Directional signs (at decision points) Attendants (at information desks) Self-help telephones (at entrances and/or decision points) Reference points (architectural and other features)
Identification of destinations □	Information to confirm that visitors have arrived at the destination	Identification signs (as appropriate) Objects themselves do not need signs (if recognizable and nameable)

(Arthur and Passini, 1990)

Transportation communications systems fall into three groups:

- **Pre-trip communications systems** give the traveller information in the home or office.
- **Terminal communications systems** provide information in the terminal about locations of facilities, scheduling and routing, and boarding procedures.
- **Vehicle communications systems** provide information on board the vehicle about emergency procedures, on-board services, de-boarding procedures, and connecting carriers.

5.2.1 Urban Trip Planning Systems

Pre-trip communications systems provide planning information on services offered, routes, schedules, and fares. Many Canadian transit systems have automated voice-message systems in operation. The most basic systems are computerized data bases that give customers information in reply to telephone inquiries. The more advanced systems allow callers to use touch-tone telephones to book trips. Interactive Voice Response (IVR) systems have been developed for paratransit services for travellers with disabilities.

BusLine, the IVR system used in Victoria, was developed by Oracle Communications Inc. (Geehan, 1994). HandyLine, a similar system for paratransit services in Vancouver, permits automatic confirmation or cancellation of requests for service (see Figure 5.1). Customers can communicate with both systems using touch-tone telephones (Geehan, 1993).

The Vancouver HandyLine system was installed in 1991. By 1996, it had run continuously without interruption for modification or maintenance. A second generation of IVR systems has been developed by Oracle Communications. These IVRs are designed to work with automated scheduling systems. Calgary Handi-Bus has installed the new IVR system on their Trapeze QV scheduler. This IVR, called HandyQ, will provide Handi-Bus customers with an automatic trip confirmation and cancellation capability, as well as information of a general nature and urgent last-minute bulletins. The confirmation and cancellation capabilities were expected to provide an early payback to Handi-Bus by off-loading significant numbers of operator-handled calls to the automated system.

The IVR system provides an automatic dial-out capability to notify callers of available trip times, changes in trip status, or any other Handi-Bus initiated messages. An automatic trip request/booking capability is to be added. The over-the-phone booking capability connects the caller directly to the Trapeze QV scheduler without the need for an agent. The system is expected to be cost-effective at very low usage rates.

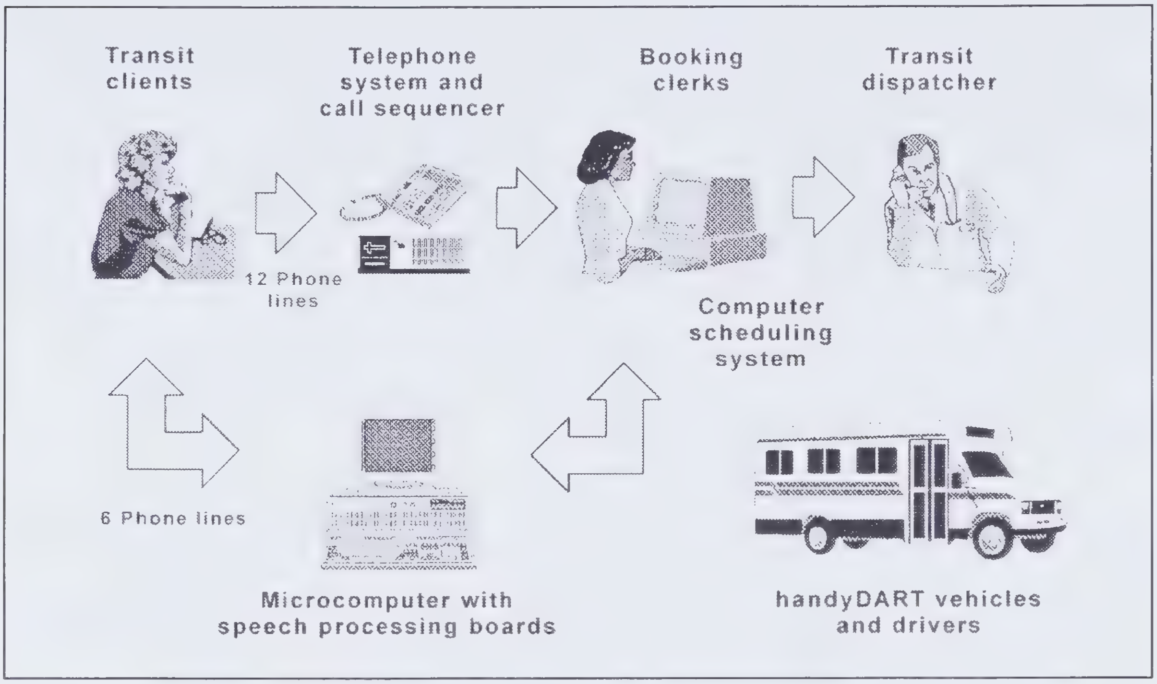

Figure 5.1 **HandyLine telephone system**
(BC Transit)

To make the systems easier to use, additional ergonomics research is required to improve menu development, information provision, and voice inflections and tone. Some qualitative work has already been done in this area (Martin, 1990; Williges, 1992).

5.2.2 Passenger Terminal Communications Systems

Passenger terminal communications systems can provide information on building layouts as well as up-to-date, real-time schedules. Fixed timetables and chalkboards have been replaced over the years by a wide array of electronic display devices, with increasing levels of integration and automated control.

Electronic and computer display devices located at stations and en route stops can provide up-to-date information on delays, cancellations, reroutings, and terminal layout and services. These systems may be interactive with traveller input. They vary in complexity from simple closed-circuit television monitors that show scheduled vehicle arrival and departure times to large-format, sensitive map displays combined with sophisticated algorithms to assist travellers in finding the best routes to their desired destinations. Specific applications can link automatically to vehicle location or identification systems to provide real-time updates on transit system status.

Bus stops in Stockholm, Sweden, are being equipped with a computerized real-time passenger information system that provides a digital and voice "next arrival" notice (Labell, 1992). Electronic display boards that show the arrival time of the next bus are being tested at stops in London, England; the system uses vehicle location signposts that relay the information to the display boards (Besette and Cartier, 1992).

Westinghouse is developing a system called *Smartkiosk* that will enable travellers to retrieve information from both static and real-time data bases (Labell, 1992). The static data base will provide information on local restaurants, hotels, and points of interest. The real-time transit data will come directly from a transit operations centre. Travellers will access the information through interactive computers, but they will also be able to obtain a hard copy of requested schedule information for future reference. Houston has deployed *Digiplan* terminals in three key downtown locations (Besette and Cartier, 1992). Tourists are given a cartoon-style map of the city with the bus system superimposed. By touching the screen at their desired destination, they are shown the route to take. They can also push a button to receive a printed version of their directions.

The automated information kiosk *Communicaid* (Figure 5.2) was developed under the sponsorship of TDC by Rutenberg Design Inc. This system provides such information as flight arrivals and departures, location of facilities, ground transportation, and accessible hotels, for people with visual, speech, or hearing disabilities, as well as for the general public. The *Communicaid* kiosk has a colour touch screen with simplified controls, and magnification and contrast adjustment for people with visual disabilities. The information is presented in large-text, audio, and symbol modes in English and French. *Communicaid* is installed at Toronto's Pearson International Airport and at Montreal's Dorval Airport. *Translaid*, a portable translation terminal, was also developed by Rutenberg Design Inc. under TDC sponsorship (Rutenberg, 1993a). It is presently installed at the international counter of Canadian Airlines at Terminal 3 at Pearson International. It permits individuals with speech or language difficulties to communicate directly with a service agent by keying appropriate questions and responses on a dual-screen computer terminal. The display on the passenger side uses audio, text, and symbol modes. *Translaid* currently provides eight languages: German, Spanish, English, French, Italian, Russian, Chinese, and Japanese. The device has capacity for 16 languages on the passenger side. It can be applied to other transportation terminals with similar communications problems.

5.2.3 Wayside and In-Vehicle Systems

Vehicle information and communications systems can range from simple washroom occupancy signs on an aircraft to complex route guidance systems in private auto-

mobiles. Displays and communications devices that provide information on routes, schedules, and connecting services help travellers, as do remote telephones and computers. Knowing that a trip is on schedule and connections are on time can help to reduce stress.

Transit operators are realizing that they should provide both visual and audio information to passengers. They now identify major intersections and key transfer points to enable travellers with visual and hearing disabilities to use fixed-route transit with confidence.

Video displays: The rapid-transit district of San Diego, California, currently uses a system based on video display terminals (VDT) on board their vehicles, and a multipurpose information terminal at strategic positions in the system. The displays are accessible to persons with disabilities and are multilingual.

Minitel terminals: A system developed and deployed in France uses Minitel terminals in homes and VDT displays on board vehicles and at bus stops to display information derived from the system's Automated Vehicle Location (AVL) system.

Light-emitting diodes (LED): LED readerboards with single or multiple colours, a two-dimensional array of display letters, and numbers or symbols can provide some animation, depending on the system capabilities. Information is received from LED display panels at vehicle stops and on board vehicles.

Talking signs: Travellers with visual, cognitive, or reading disabilities or with language barriers can keep informed of their location as they progress along a route or pathway by using a system that comprises a pocket-sized receiver and multiple transmitters. Applications of this development can be found in the Bay Area Rapid Transit system around San Francisco and in L'Enfant Plaza, Washington, D.C.

Automated vehicle location systems: A system in the Netherlands uses AVL information to provide real-time timetable adjustments. Schedule and next-stop information is presented visually by LED readerboard and audibly by digitized voice to vehicle passengers.

Passenger information at bus stops: This system is used by London Transport, England. It presents information on the route, destination, and minutes-to-arrival of the next three buses at a single-route stop, and the next seven buses at a multiroute stop.

Digital messaging systems: Digital Recorders Inc. has responded to the need for on-board verbal cues with *Talking Bus*, a voice messaging system that announces stops and other necessary information. The system was tested by the Durham Area Transit Authority in North Carolina (Labell, 1992). Luminator has introduced a voice annunciator activated when the bus door opens; it broadcasts the route number and destination of the bus to passengers waiting at the stop. For travellers with visual impairments, Luminator has developed the *MegaMax* large-format matrix sign, which is double the size of the standard sign at the front of a bus (Labell, 1992; Atkinson and Geehan, 1994).

Figure 5.2 ***Communicaid*** **kiosk**
(Rutenberg, 1992)

The Visual Communication Network (VCN), developed by Telecite, has taken in-vehicle automated sign systems one step further by providing passengers with stop announcements and emergency information both visually and orally (Moreyne, 1990; Bourion, 1992). In addition, animated colour graphics and continuous programming keep passengers updated on current news, weather, sports, cultural events, and other items of educational interest (see Figure 5.3). Audio information is communicated with a digitized voice. The object is to assist those with hearing and visual impairments, and to increase the appeal of using public transit. VCN signs can also effectively provide paid advertisements or public-service announcements. They are in use in the Montreal subway and at the shuttle-bus terminal platform at the Kansas City, Missouri, international airport.

Other advances in the development of passenger information systems include flat-panel liquid-crystal displays (LCD), flip-dot displays, fibre-optic displays, new developments in LED technology and real-time systems, and design improvements for disabled travellers (Hunter-Zaworski and Rutenberg, 1994).

Figure 5.3 Telecite information display
(Montreal Urban Community Transit Commission)

5.2.4 Integrated Communications Systems

Automotive, electronics, computer, and communications technologies such as the Global Positioning System (GPS) have rapidly progressed to a stage where they can be combined into integrated systems (serving drivers, vehicles, and roadways) to improve operational efficiencies and road safety.

Formerly called Intelligent Vehicle Highway Systems (IVHS) and now referred to as Intelligent Transportation Systems (ITS), applications for such systems are rapidly being developed by ITS America; ITS Canada; the European Road Transport Telematics Implementation Coordination Organization (ERTICO); and Japan's

Vehicle, Road, and Traffic Intelligence Society (VERTIS). They offer an effective base for improving accessibility and independence for seniors and persons with disabilities.

In Canada, researchers have developed a conceptual framework for an Advanced Traveller Accessibility System (ATAS) that uses ITS technology to address the needs of travellers with disabilities (see Section 8.9.10). Micro-electronic signal transmissions provide an unequalled opportunity to develop information systems, and their application could enable travellers to compensate for their disabilities.

Input, response, and output devices such as voice recognition, speech-to-text, amplified text, and use of joysticks and track balls could make access to information possible even for persons with multiple disabilities.

Because of their almost limitless capacity, speed, and content, these technologies could also eliminate local, national, and international boundaries (Suen and Rutenberg, 1994).

5.3 Human and Environmental Factors

Most travellers with disabilities manage to find their way through confusing and complex environments. Some, however, are not so skilled and are much less independent. For these people, buildings can be confusing and hazardous. Attention to design, therefore, can make transportation terminals more accessible.

Effective transmission of information depends on numerous human and environmental factors. While human factors vary with the individual and are beyond the control of designers, a general understanding of how these factors affect the viewer's response to communications systems is important. By using various environmental factors such as lighting, textures, and colours, designers can create a psychological environment that gives the viewer a greater awareness of the message, thereby enhancing the effectiveness of the communications system.

5.3.1 Human Factors

Human perception of and response to a communications system are conditioned by certain physical, psychological, and perceptual characteristics, such as the quality of a person's eyesight, hearing, reading ability, colour sensitivity, cognitive ability, and mental attitude. These are referred to as "human" or "ergonomic" factors. They include a person's ability to see or hear the information clearly (physical factors) and to understand the information (psychological factors), as well as the viewing conditions at the site (perception factors).

The designer of a communications system needs to take into consideration the following physical factors:

- **Field of vision:** Areas outside a normal field of vision tend to be seen in less detail.
- **Visual acuity:** Viewers differ considerably in their ability to see clearly.
- **Reading rate and comprehension:** Individual reading rates vary widely, depending on literacy and language skills.
- **Eye level:** Measured from the ground, the average eye-level height of a standing person is about 1.7 m; when sitting, about 1.3 m.
- **Hearing:** If audible messages are not reinforced with visual displays, the messages may be lost.
- **Functional abilities:** Many people have special communications needs.

Given the broad range of human factors, it is evident that no visual communications system can succeed equally well with all viewers. Psychological factors must also be considered:

- **Figure-background relationships:** This refers to the perception of shapes or patterns against a background. Anything that affects a clear perception of shape may affect recognition of the object. Excessive crowding, low contrast, and shadows from raised letters present problems.
- **Implications of colour:** Individuals vary considerably in their ability to distinguish and remember colours. A person whose vision is not otherwise colour impaired can probably distinguish only six different colours readily, excepting white and black: red, yellow, blue, green, orange, and brown.
- **Ambiguity of symbols:** Even one of the most simple symbols, the arrow, can be ambiguous. The confusion arises in deciding whether an arrow that points down, for example, means "ahead" or "down". Most viewers apparently have adjusted to the fact that an arrow pointing down may indicate "ahead" in one situation and "down" in another.
- **Clarity of copy:** Because certain phrases tend to be ambiguous or subject to personal interpretation, it is important to ensure the message is consistent, is stated positively and briefly, and means the same thing to all viewers. For example, restrooms may be designated "men" and "women" or "gentlemen" and "ladies".
- **Repetition:** It is important to repeat the message at least once.

Perceptual factors also require consideration:

- **Viewing angle:** This is the angle formed by the plane of a sign and the observer's central line of vision. Ideally, a sign should be placed at right angles to the line of vision, giving a viewing angle of 90 degrees. The legibility of a sign message deteriorates when the viewing angle is less than 45 degrees.

- **Viewing distance and character size:** The selection of character size is generally based on the normal viewing distance. Viewing distance, message length, character size, and sign dimensions are interdependent factors.
- **Legibility:** Distance studies indicate that in normal daylight a person with 20/20 vision can read letters 25 mm high on a standard Snellen eye chart used by optometrists at a distance of 15 m. A letter height of 25 mm for a viewing distance of 7.5 m is probably a more practical guide for seniors and persons with disabilities, and to meet broader public needs.
- **Luminance contrast ratio:** The LCR is the ratio of the luminance of the object being viewed to the luminance of the background.
- **Audibility:** Certain sounds (e.g., t, k, and b) are easily confused with each other in a noisy environment. Other sounds (e.g., sh, v, and f) are difficult to hear because they have little sound energy. Familiar words are easier to understand (e.g., "leave" is better than "evacuate"). For public address (PA) systems, the selection of speaker systems and their frequency range are critical. Some types of speakers are uni-directional and therefore do not provide broad coverage.

5.3.2 Environmental Factors

Many environmental factors influence an observer's ability to perceive a specific information system, to read its message, and to act upon it. These factors include the viewer's ability to see or hear the information clearly due to the conditions at a site. Some examples include the angle from which a sign is normally viewed, the quality and intensity of the light falling on a sign, obstruction of the sight line between viewer and sign, glare from light sources around a sign, and the environment behind or around a sign (e.g., competing signs or distracting noises).

Whether an information system is in a natural or an architectural environment, it modifies its surroundings. Communications systems not only become part of their surroundings, they also reflect on the organization occupying the space. Signs, for example, are developed to meet the objectives of corporate policy, the requirements of the organizations using them, and, most importantly, the needs of the users for orientation and wayfinding. One purpose of signs is to help. They constitute a communications system that enables users to function in that space. For a variety of reasons, however, signs tend to detract from the surroundings. This is particularly true of oversigning.

Some environmental factors may be beyond the control of the designer, but many closely related design factors can be controlled. Artificial lighting can be used to increase the perception of communications systems. Lights can be placed to improve sight lines. Most design elements of a sign can be adjusted to improve readability, thus compensating for a poor physical environment.

5.4 Guidelines for Planners and Designers

Some basic environmental communication guidelines that should be recognized and considered when designing orientation and wayfinding information for transportation terminals are provided below (Geehan, 1996).

For travellers with visual disabilities

- Locate signs 1.3-1.6 m above floor level.
- Use sans serif letters on signs; numbers should be Arabic; and both should have a minimum width to height ratio of between 3:5 and 1:1 and a stroke width to height ratio of between 1:5 and 1:10.
- Provide excellent contrast between the letters and the background (yellow on black is best although yellow on green, blue, or brown also provide a high contrast).
- Provide good lighting levels (200-300 lux) near signs, controls (100 lux), and on ramps and stairs (100-300 lux).
- Avoid shiny surfaces, which create glare on signs, and avoid shadow areas.
- Avoid using certain colours (particularly red and green) together in signs.
- Use tactile signs with the characters or symbols raised at least 1 mm, between 1.5 and 5 cm high, and located at a height of 1.5 m $\pm$ 2.5 cm.
- Supplement symbols or pictographs with Braille cells presented in Grade One Braille that meets the standards of the Canadian Braille Authority in English and in *Braille integral* that meets the standards of the Comité interministériel sur la normalisation du braille in French.
- Use consistently located visual cues featuring colour/brightness contrasted tones to accentuate specific areas of service.
- Provide directional guides or tactile cues from entrances to the information desk, and simple directions from one cue sign to the next.
- Provide verbal or tactile information (descriptive audio cassette recordings or tactile maps that are carefully designed and easy to access) about the building or vehicle layout.
- Provide a telephone information service that gives directions to the terminal and to the information booth (it is important to have a dedicated "help" line with the location of the telephone known to the telephone operator).
- Provide auditory identification cues both inside and outside elevators, presented at least at 20 dB at 1500 Hz.
- Consider alternative technologies such as talking signs, auditory pathways, audio cassettes, and synthesized speech output.

For travellers with hearing disabilities

- Train staff to speak slowly and distinctly, and to look directly at the traveller while being careful not to cover the mouth.
- Provide good lighting on the attendant's face for easy lip reading.
- Provide attendants with note pads.
- Equip self-help and other public telephones with the necessary fluxcoil for hearing aid users who use a "T" switch.
- Avoid acoustic interference from lighting fixtures.
- Provide assistive listening devices (induction loop, FM radio, or infrared systems) in appropriate areas.
- Provide TTY/TDD (telecommunications devices for those with impaired hearing).
- Provide closed or open captioning of video or film programs, including public televisions in bars and waiting areas.
- Design the intensity of auditory messages to be about five times that of the background noise.
- Design auditory messages with a frequency different from that of the background noise.
- Remember that the intensity of sound decreases with the inverse of the square of the distance; therefore, the position of speakers is important.
- Consider visual pagers or electronic sign boards to display public address announcements.
- Provide visual alarms (lights that flash at 1 Hz in conjunction with audible alarms) in washrooms and other areas where there may be no other visual indication of an emergency.

For travellers with speech disabilities

- Provide a pad and a pencil and simplified area maps at the information desk.
- Train staff to be understanding.
- Ensure that staff can use symbols to communicate.

For travellers with literacy or reading disabilities

- Use pictograms and symbols that make the words easier to understand.
- Use symbols that do not have a complex design or contain small visual details.
- Use only simple, well-understood symbols.
- Use plain language and as few words as possible in signs.
- Offer verbal assistance, self-help telephones.

For travellers with cognitive disabilities

- Train personnel to use common sense and to be understanding.
- Use simple, plain language in signs.
- Use repetition and redundancy to ensure that traveller understands.
- Use consistency in the display of signs.

For travellers with impaired mobility

- Eliminate barriers between travellers and signs.
- Use consistency in displaying signs (placement, colour, format).
- Provide signing of accessible routes.
- Provide physical access to maps, directories, and information services.
- Consider the lower eye level of people in wheelchairs.

Communications systems should be well planned and integrated into the overall environment and the wayfinding information system to resolve orientation problems. Use multiple media (print, voice, tactile, digital). The term "environmental communications" includes aids such as graphics, maps, directories, symbols, letters, and spoken messages. Solutions to orientation and wayfinding problems are possible through appropriate visual, auditory, tactile, and kinesthetic cues; speech, large-print, or Braille technologies; visual backup of auditory messages, and assistive listening and telecommunications devices; simplification and standardization; and trained human resources. Clear, simple designs and direct, easy-to-access information systems are required to create an environment that meets the orientation and mobility needs of persons with perceptual or cognitive disabilities.

For more detail on this topic readers should consult:

- Section 2.4 for customer communications for trip planning;
- Sections 3.4.15 and 3.4.16 for the location of communications facilities;
- Section 8.8 for research and developments in communications technology;
- Section 17.4.1 for multimodal travel requirements;
- The Canadian Standards Association (CSA);
- The Bibliography.

– 6 –

SAFETY AND RELIABILITY

– 1 – INTRODUCTION

CUSTOMER ACCESS

– 2 – TRIP PLANNING	– 3 – ROADWAYS & TERMINALS	– 4 – PERSONAL VEHICLES

SYSTEM ACCESSIBILITY

– 5 – COMMUNICATIONS SYSTEMS	**– 6 – SAFETY & RELIABILITY**	– 7 – TRAINING	– 8 – RESEARCH & DEVELOPMENT

PUBLIC CARRIERS: LOCAL

– 9 – ACCESSIBLE TAXIS	– 10 – URBAN BUS SYSTEMS	– 11 – URBAN RAIL SYSTEMS	– 12 – RURAL SYSTEMS

PUBLIC CARRIERS: INTERCITY

– 13 – AIR TRANSPORT SYSTEMS	– 14 – INTERCITY RAIL SYSTEMS	– 15 – INTERCITY BUS SYSTEMS	– 16 – MARINE SYSTEMS

– 17 – MODAL INTEGRATION

6 Safety and Reliability

Travel by public carriers is relatively safe and reliable compared to travel by private automobile. This is because of a combination of rigorous safety standards and intensive training of carefully selected operating and maintenance staff. By contrast, private automobiles are operated by persons with a wide range of abilities, training, and experience.

There is no evidence to date that public carriers are any less safe for customers with disabilities. However, there is ample evidence that both pedestrian and automobile travel is less safe for seniors and for persons with disabilities.

The question of system reliability is of considerable interest to persons with disabilities. For most travellers, a failure of a particular transportation mode may simply require a transfer to an alternative mode. For example, one could drive, take a taxi or bus, even charter an aircraft if urgency demanded and cost was not a constraint. For a person with a disability, alternative modes may not be an option, and, for some, the cost may be a constraint.

System reliability is often related to trip purpose for persons with disabilities. For example, urban paratransit-system operators place an absolute priority on certain medical trips, such as those for dialysis treatment. In the case of a vehicle breakdown, such operators will delay other passengers to accommodate a medical need that cannot be delayed or rescheduled.

Another facet of reliability involves reassuring passengers that they are on the correct vehicle, heading in the intended direction, and in a safe environment. How well this is communicated to passengers influences their decisions to select a particular mode or carrier.

Assurances of safety and reliability should include customer needs and perceptions:

- safety standards governing the design of vehicles and equipment;
- safety regulations and procedures for passengers;
- staff training, including sensitivity training;
- customer communications;
- simulation and evaluation.

6.1 Safety Regulation

In Canada the responsibility for transportation safety regulation is shared among the three levels of government and the carriers as follows:

Federal agencies

- Transport Canada: Responsible for national safety standards and regulations governing air, rail, and marine transport, and the manufacture or importation of motor vehicles.
- Canadian Transportation Agency: While not directly responsible for safety regulations, the CTA regulations and Codes of Practice include safety issues related to travellers with disabilities.
- Transportation Safety Board of Canada: The Board is an independent agency reporting to Parliament; it is responsible for conducting independent investigations and inquiries into accidents and issues of safety in air, rail, and marine transportation.

Provincial and territorial transportation agencies

- Responsible for administering the *National Safety Code for Motor Carriers* (trucks and buses) (CCMTA, 1988), for enacting legislation governing pedestrian and vehicular traffic, and for licensing motor vehicles and drivers. In addition, some provinces also enact safety standards and regulations governing provincial railways, urban transit systems, and ferry systems.

Local governments

- Responsible for applying national safety standards to the design of traffic control systems, and the enactment of bylaws governing traffic, taxi, and transit operations.

Carriers

- In addition to the activities of the various levels of government, all public carriers develop internal rules and regulations for the safety of passengers and carrier personnel.

6.1.1 National Standards

Most of the formal legislation governing transportation systems in Canada does not refer specifically to the safety of travellers with disabilities. This situation has resulted in the development of a variety of specialized vehicles and mobility devices to accommodate specific needs. National consensus standards have been and are being developed to provide guidelines for the manufacture of such devices. The agencies involved in the development of voluntary standards include the following:

- Standards Council of Canada, which serves as the focal point for all voluntary standards;
- Canadian General Standards Board (CGSB);
- Canadian Standards Association (CSA).

The CGSB recently developed a national standard for lifting devices that provide access to smaller aircraft (see Section 13.4.2). The CSA developed and published CAN/CSA-D409-92 for *Motor Vehicles for the Transportation of Persons with Physical Disabilities*. Since 1990, the CSA, with the support of Transport Canada, several provinces, and the Canadian Urban Transit Association, has developed consensus standards for *Transportable Mobility Aids* (CSA-Z604) and for *Mobility Aid Securement and Occupant Restraint Systems* (CSA-Z605). These standards were published in December 1995. Subsequent modifications to CAN/CSA-D409-92 will be required to harmonize with Z604 and Z605. Table 6.1 presents some highlights from the current CSA standards.

Difficult compromises have had to be made between the objectives of improved accessibility and safety. Several factors contributed to this dilemma:

- the emergence of fully accessible, large transit vehicles in which the passenger mix and the level of necessary occupant protection differs markedly from the smaller accessible paratransit vehicles;
- the incompatibility of the characteristics of a mobility aid (lightness, manoeuvrability) and the protection of a fixed vehicle seat;
- the diversity of wheelchair and scooter designs;
- the widely differing expectations of consumers, manufacturers, transit operators, and regulatory authorities.

6.1.2 Safety Regulations for Low-Floor Urban Buses

Safety standards for low-floor buses and for wheelchair securement in these buses are an international concern. Several countries (Germany, England, and Canada) are involved in research efforts to solve this problem (Rutenberg, 1995c).

Canada has no safety regulations at present for low-floor urban buses that transport wheelchair passengers. The practice is to allocate two places per wheelchair or scooter and to secure them, facing forward, by means of two and three belts, respectively. Passenger restraint belts are optional.

The Ministry of Transportation of Ontario is developing regulations for the design and manufacture of accessible low-floor buses. These standards will constitute a revised version of *Regulation 629 for Transit Buses*.

Table 6.1 Scope of current CSA standards (applicable to transportation vehicles and mobility aids)

CAN/CSA-D409-92	**Motor Vehicles for the Transportation of Persons with Physical Disabilities**
Application	Gross vehicle weight rating (GVWR) of less than 10,000 kg
Floor space	68.5 x 111.5 cm
Ramp slopes	1:4
Wheelchair spaces	not specified
Passenger position	facing forward or rearward
Wheelchair securement	4 point anchorage: 2 front/2 rear
Passenger restraint	lap and torso belt
(plus detailed specifications for vehicle chassis and service ramps)	
CSA-Z604-95	**Transportable Mobility Aids**
CSA-Z605-95	**Mobility Aid Securement and Occupant Restraint Systems**
Application	GVWR of less than 7,000 kg
Maximum floor envelope	68.5 x 122 cm
Maximum height limit	emergency door
Ground clearance test	on 15° slope within 30° of perpendicular
Obstacle climbing ability	4 cm
(plus detailed specifications for construction, marking, and crash testing)	

(Canadian Standards Association, December 1995 – see note in box)

Germany was one of the first countries to adopt accessible low-floor buses. Transport authorities in Germany conducted two significant studies on wheelchair stability and securement design. The studies showed that wheelchair passengers can be transported safely in a full-size transit bus without a securement system provided that:

- there is a confined space with a back-support panel for the wheelchair;
- the wheelchair is facing rearwards with its back in contact with the support panel;
- the brakes of the wheelchair are firmly applied;
- the driver exercises reasonable driving habits;
- the speed does not exceed usual urban speed limits.

As a result of this research, a number of transit authorities in Germany have developed a *protected position* design for accommodating mobility aids on board full-sized buses.

A refined version of the protected-position design was demonstrated in London, England, in 1994. In these buses the wheelchair position is located on the door side. Wheelchair users are instructed to board and face rearwards, positioning themselves in the designated location. The design provides a padded rest behind them, a padded area on the window side (with flip-down seats), and a vertical stanchion on the aisle side. No other securement devices are required, nor is a passenger restraint provided (Dejeammes and Bonicel, 1993).

6.1.3 Aviation Safety

The Civil Aviation Directorate of Transport Canada's Safety and Security Group is responsible for aviation safety and has developed safety standards for Canadian conditions.

Safety features in the design and interior fittings of an aircraft are governed by the strict safety requirements in force for aircraft manufacture and use. The U.S. Federal Aviation Administration (FAA) has issued safety regulations and directives that form the basis of most international civil aviation regulations. All fuselage exits, whether or not provided with slides, are intended for use in an emergency. The number of exits and slides is based on the balance between the numbers of passengers and of personnel required for emergency evacuation, and on the fact that under any circumstance the time required for evacuation must never exceed 90 seconds.

All passengers are required to occupy an aircraft seat and must wear seat belts for take-off and landing. Passengers with disabilities are prohibited from occupying an emergency exit row seat.

6.1.4 Rail Safety

VIA Rail Canada Inc. is regulated by the federal government under the Railway Safety Act, 1989, and the Canada Transportation Act, 1996. Transport Canada's Railway Safety Directorate develops the regulations and standards governing railway safety.

Municipal and provincial commuter rail services are operated under provincial railway legislation.

6.1.5 Marine Safety

The Ship Safety Branch of Transport Canada regulates the design and construction of ships, their machinery, fittings, and equipment, under the Canada Shipping Act. The Branch defines the proper methods for loading, unloading, and stowing cargo. It also sets national standards for safe working practices in ships; the use of life jackets and other emergency flotation devices; the number, qualifications, and certification of sea-going personnel; bridge-to-bridge communications between ships; and safe navigating procedures.

6.1.6 Motor Vehicle Safety

The Canada Motor Vehicle Safety Standards (CMVSS) ensure that all new motor vehicles manufactured in or imported into Canada meet minimum vehicle safety and environmental protection criteria. The Road Safety and Motor Vehicle Regulation Directorate of Transport Canada enforces the CMVSS provisions.

Original equipment manufacturers (OEM) are responsible for ensuring that their vehicles comply with CMVSS. This responsibility includes a requirement to recall the vehicle for up to five years to correct any defective components that affect safety. When significant modifications are made to an OEM vehicle, the secondary equipment manufacturer (SEM) must certify that the modified vehicle meets the required safety standards and must be responsible for any recalls due to the modifications.

The Road Safety and Motor Vehicle Regulation Directorate of Transport Canada administers the Motor Vehicle Safety Act and the Motor Vehicle Tire Safety Act, and enforces the pertinent regulations.

6.1.7 Highway Safety

In Canada, the federal Motor Vehicle Transport Act (MVTA) allows the provinces to apply their laws and regulations to extra-provincial bus companies. The only direct federal regulation of these companies is the Commercial Drivers Hours of Service Regulation 1994, which limits the driving and on-duty time for drivers working for these companies.

Numerous provincial and territorial laws and regulations play a role in the day-to-day regulation of the intercity bus industry. Each provincial and territorial transport board or commission develops its own rules and procedures. These agencies can specify bus routes, capacity, service quality, safety standards, and insurance requirements. Ontario has announced that it will remove economic regulation requirements and will only regulate safety and insurance requirements as of January 1, 1998.

6.2 Reliable Performance

To the consumer with a disability, reliable performance means that the carrier performs as advertised, or makes provisions to ensure that the customer is able to complete an intended trip successfully. This expectation may require the carrier to provide a back-up service.

6.2.1 Urban Transportation

Most of the performance indicators for fixed-route transit services apply to taxi and paratransit services for seniors and persons with disabilities. The data take into account revenue and ridership as well as hours, kilometres, and loading characteristics. Monitored data are needed on the following:

- number of active users in registration files
- unsatisfied telephone contacts
- unsatisfied trip requests
- trip cancellations
- customer no-shows
- double booking of trips
- excessive vehicle travel times
- customer complaints
- maximum advance trip booking time

Paratransit systems usually divide trips into the following categories:

- subscription trips
- pre-booked trips
- advanced reservation trips
- on-demand trips

Much of the monitored data comes from the exceptions noted by drivers and dispatchers on log sheets. Periodic checks are made on in-vehicle travel time and on actual arrival times at destinations versus promised times.

Cancellations and no-shows as well as double bookings are symptomatic of a service that must be booked too far in advance (Hickling, 1990). The paratransit systems that can handle some last minute bookings (demand-responsive service) experience fewer cancellations and no-shows, which should not exceed 1 percent of total trips; cancellations and no-shows combined should not exceed 8 percent. Most of the larger paratransit systems maintain a staff of public relations officers who follow up on cancellations, no-shows, and complaints. In evaluating complaints, it is important to differentiate between errors in customer communications and failures in service operation.

6.2.2 Intercity Systems

The single most important concern for travellers is whether the information they are given is reliable: "Is my train to Toronto really leaving from gate 8, as shown on the schedule, or has the gate number been changed?" or "Is the departure time still correct?".

Intercity carriers are mainly concerned with on-time performance. They do not focus on problems like accidents or incidents with passengers. Passengers, on the other hand, are concerned about the availability of alternative modes and back-up systems in case the primary mode is unable to operate or is rerouted. For them, last-minute changes in departure gates and departure delays can be stressful.

6.3 Safety Issues

The relative safety of travellers with disabilities is difficult to assess because Canadian statistics have not focused sufficiently on the pertinent issues. Data are collected by insurance companies, police agencies, and traffic safety officials for different purposes. Research on the following would be needed to produce meaningful data:

- safety in boarding, deboarding, and traversing moving vehicles;
- the safe storage of mobility devices on board;
- the ability to hear and understand public address (PA) systems in vehicles and terminal facilities, including the washrooms;
- security at night and during periods of low demand;
- the ability to understand and carry out emergency procedures.

Emergency measures must be related to the activities of passengers and to their mental and physical abilities. The development of such measures often requires special technology as well as personnel training, management planning, and emergency simulations.

Passengers in motion constantly challenge emergency measures. Age, mental and physical conditions, education, assimilated information, and applied experience are major factors influencing their ability to cope with such measures.

Transportation vehicles and terminals become artificial environments that hold and protect personnel and passengers. The design and structure of transportation facilities must incorporate detection, alarm, notification, communication, evacuation, and refuge systems for emergencies.

6.3.1 Urban Bus Systems

Full-sized urban transit buses are among the safest of passenger vehicles. The whole bus is designed to absorb impacts in a collision. Most buses are equipped with soft bumpers in front to lessen the effects of a pedestrian-bus collision.

Most accidents on full-sized urban buses result from passengers losing their balance as the bus is set in motion or when they are exiting. Smaller paratransit vehicles – and their passengers – may be subjected to much greater forces during a collision. Consequently, it is important to have adequate systems to secure mobility aids in all vehicles, as well as passenger restraint systems for all passengers.

6.3.2 Urban Rail Systems

The single issue of greatest concern to passengers on urban rail systems is that of personal security. For the newer systems, planners and architects have designed anti-crime and safety features into the terminals. Such features include large open spaces and curved walls without hiding places, secure fare-card validation systems, and surveillance equipment.

The Toronto Transit Commission has set up designated waiting areas (DWAs) in the subway system to reduce violence and vandalism (see Figure 6.1). Passengers waiting in these areas have direct access to emergency assistance by means of intercoms and the on-board guards stop directly in front of them.

Although not designed expressly for travellers with sensory or cognitive disabilities, a DWA could be of assistance to them while boarding. Travellers requiring special boarding assistance could use the intercom system to contact a passenger-service attendant. To be effective, such a service has to be well advertised and its proper use explained to the public.

Figure 6.1 Designated waiting area in a Toronto subway station
(Toronto Transit Commission)

6.3.3 Aircraft

Many travellers, including those without disabilities, have potential problems with carrying out emergency procedures. Special procedures are needed for passengers who use wheelchairs. During an emergency, all information from the flight crew is

provided auditorily. This puts travellers who are deaf or hearing impaired at a disadvantage. Such travellers are often unsure of what is happening because all the information during an emergency is given either over the PA system or orally by the flight attendants. Travellers with auditory disabilities are able to observe general visual cues, such as passengers reaching for oxygen masks or flight attendants putting life jackets over their heads, but they would feel much more secure during emergency situations if they were provided with written information and captions explaining procedures when they board the aircraft (Arnold, 1993).

6.3.4 Intercity Rail Systems

Obtaining information about safety/emergency procedures is difficult for all travellers, including those without disabilities. The main reason for such difficulties is inadequate information. There are no safety videos or manual safety demonstrations on trains as there are on aircraft. While there are signs indicating the locations of emergency exits, they are inadequately designed for the needs of persons with visual disabilities.

VIA Rail has developed a safety/emergency procedures brochure that has been available to all passengers on all trains operating in the system since 1996.

6.3.5 Intercity Buses

Safe transportation for wheelchair passengers on intercity buses is achieved by providing designated places and securement. The securement consists typically of four belts, two to the front and two to the rear of the wheelchair. Passengers able to transfer may use aisle-facing seats that have pivoting armrests, which facilitate the transfer from wheelchair to seat.

Personal security is also of concern. Terminal facilities can become a centre for illegal and undesirable activities that have little to do with transportation. Attention to security and anti-crime design is needed, as for urban rail terminals.

An ergonomic study of intercity bus operations concluded that obtaining information about safety/emergency procedures is difficult for all travellers, including those without disabilities. At present, on intercity and charter buses, most of this information can only be obtained by asking questions of the driver. No information is available to indicate the appropriate emergency evacuation procedures. Emergency exit signs are the only visual information on board regarding safety/emergency procedures. Some emergency window exit signs now have tactile (raised) lettering (Arnold, 1993).

6.3.6 Ferry Systems

Obtaining information about safety/emergency procedures is difficult for all ferry travellers. Typically, no standard information is provided, in any form, about evacuation procedures. The information is provided only after an emergency has occurred.

Sometimes visual signs are used to indicate such things as life jackets and life boats, but they are often inappropriately placed and may use wording that is difficult to understand. Other visual signs, such as the "person-overboard" sign, are inadequate because they do not include procedural instructions.

6.3.7 Pedestrian Systems

Seniors have the highest pedestrian accident rate of any Canadian population segment. On a per capita basis, the fatality rate for senior pedestrians is 2.5 to 3 times as great as for the total population.

While 82 percent of seniors have few mobility limitations, this population segment includes proportionately more persons with disabilities. Because of physical disabilities and/or the deterioration of major body functions due to illnesses and the aging process, such persons are faced with particular hazards when using the street system.

Because the high rate of pedestrian traffic accidents among seniors is an international phenomenon, several researchers have attempted to find common factors to explain the incidence. These investigations have concluded that seniors have a disproportionate number of accidents based on exposure rates, using such criteria as roads crossed, distance walked, and hours spent in walking.

It is perhaps not surprising that more than half of these accidents occur because pedestrians cross roadways at locations other than an intersection. It is surprising that about 21 percent of the accidents occur at intersections controlled by signal lights, probably because of motorists running red lights or failing to yield when turning. A popular misconception is that a pedestrian crosswalk at an intersection offers protection, whereas it only defines an appropriate crossing location. Such a misconception, combined with driver carelessness, accounts for an equivalent number of accidents at intersections not controlled by traffic lights.

6.3.8 Operation of Personal Vehicles

While the subject of traffic safety would fill several handbooks, here the focus is on automobile safety at terminal areas.

Good design practice in terminals involves reducing or eliminating pedestrian-traffic conflicts. For example, right turns on red lights pose a major threat to pedestrians since drivers are usually looking for other vehicles rather than for people. Drivers may forget that they must bring their vehicles to a stop before a crosswalk or stop line and proceed only when their way is clear of other traffic and pedestrians. Terminal designers must, therefore, use the best available traffic separation and control techniques.

6.4 Evacuation Procedures

Efficient and effective methods for evacuating passengers with disabilities from vehicles and terminals are necessary to ensure passenger safety. Standard methods of communicating emergency procedures may not be effective for all passengers because of their varying physical or mental abilities. Travellers with visual disabilities are often unaware of the location of emergency exits or of emergency safety procedures. Travellers with hearing disabilities are often unaware of warning signals/messages provided over the public address system (Geehan and Smith, 1987).

Development of effective emergency evacuation measures for seniors and passengers with disabilities involves analysis of the inter-relationships between the passengers, the terminal, the vehicle, and the incidents causing the emergency. Figure 6.2 illustrates these inter-relationships.

6.4.1 Bus Systems

Transit buses, intercity buses, and small paratransit buses all present different evacuation problems. Closely spaced seats, narrow aisles, and high load factors hinder evacuation. In addition to the regular exits, buses often provide extra escape routes through top-hinged side windows. The window exits are difficult to open from the outside; they involve a high step-over height from inside the bus and a long drop to the ground; they are also difficult to hold open, because of the weight of the glass.

Mobility devices such as powered wheelchair lifts may block the exits during a power failure. Most buses have only a single operator, who could be incapacitated as a result of a collision, leaving travellers incapable of evacuation until external help arrives. Heavy reliance is placed on external assistance in an emergency situation (Balog, 1984).

During a recent simulation, most participants correctly assumed that they could evacuate the bus via the side windows. Most participants found the exits very quickly since their red handles were easily identifiable, but the opening instructions presented difficulties. Participants with learning disabilities found the picto-

gram too complicated, and participants with visual disabilities said the plastic covering around the sign created too much glare and that the lettering on the sign was too small.

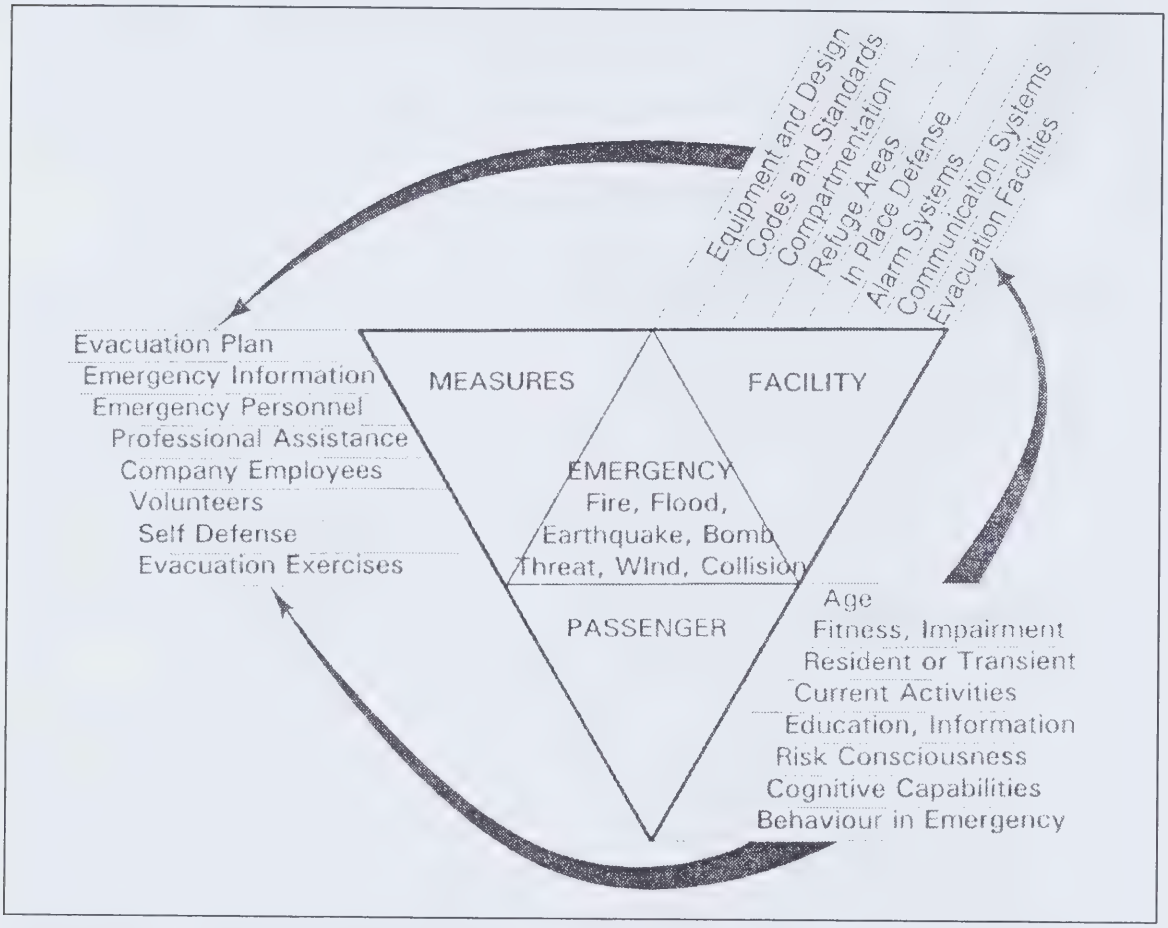

Figure 6.2 Inter-relationship of emergency factors
(Geehan and Smith, 1987)

6.4.2 Aircraft

Exiting an aircraft may not be the same as exiting other transportation vehicles. Fire is associated with almost all aircraft emergency situations, and smoke fills the cabin from the top down. Current regulations require that floor-level lighting be installed, with red lights indicating exit locations (Goldberg, 1996).

It is assumed that in an emergency most passengers are capable of reaching the exits and evacuating the aircraft within 90 seconds without much assistance. Flight attendants are given sensitivity training so that they can accommodate the

special needs of passengers with disabilities during emergencies. Seating policies are designed to ensure the greatest safety for the most passengers.

In addition to the special briefing given passengers with disabilities, flight attendants will provide them with personalized information when there is time for advanced planning. In emergency situations when there is little or no advance warning, it is impossible to provide special briefings (see also Section 6.3.3).

An example of a good information system is the lighted pathway that directs passengers to an emergency exit on most newer aircraft. Lighted pathways do not, however, meet the needs of travellers who are blind.

A problem for passengers with learning disabilities is that they may not feel confident about their ability to find the emergency exits on their own. No information is available to reassure them that they will be taken care of during emergencies.

Many participants in a recent workshop found it very difficult to put on the life jacket during a crash simulation. Participants with learning disabilities who were also blind, visually impaired, or deaf all indicated that the life jackets had too many buckles to fasten and that it was unclear how to do them up – they took almost 50 percent more time to fasten their life jackets than did the participants who had no disabilities.

6.4.3 Rail Systems

Rail vehicles operating above ground present evacuation challenges similar to those of buses and aircraft. An emergency in a rail vehicle is one in which individual action, volunteer assistance, and professional help are most advantageously combined to effect evacuation. Although no specific emergency evacuation exit or equipment is used, evacuation can be effected through the loading doors and often through the windows.

An underground emergency in a loaded rail transit train, however, presents a difficult emergency evacuation scenario. Heat, smoke, and toxic fumes in a confined tunnel require immediate response from both carrier personnel and firefighters (Gleave, 1987).

During a simulation, many of the participants indicated that they were not confident about what to do in the event of an emergency. One participant noticed that the emergency exit windows were on one side of the railcar only, and was concerned that there would be no way of evacuating if the train crashed and rolled onto that side. A participant with learning disabilities found the emergency window but could not get it open. Instead of running to one of the doors, as did the other participants, this person panicked and did not know what to do (Arnold, 1993).

6.4.4 Marine Systems

The Ship Safety Branch of Transport Canada regulates the design and construction of ships. Passenger ferries, like aircraft, have strict safety requirements. Modern ship design is an important factor in passenger safety. Instead of narrow corridors and many small lounges, contemporary design stresses high visibility, no corridors, and large open decks. Shipboard alarms are coded and intended to inform only the crew, who are well trained to deal with the situation. After the situation has been assessed, action initiated, and the crew alerted, the passengers are informed via the public address system. Passengers are not expected to take independent action, and crew members deal directly with the passengers and personally guide their actions. Coast Guard guidelines are used by ferry corporations for safety measures and equipment (e.g., abandoning ship must be accomplished in 30 minutes).

Carrying out emergency procedures poses potential difficulties for many travellers with disabilities. Many persons with sensory and cognitive disabilities feel that not enough crew members would be available during an emergency situation to provide them with personal assistance and that they would have to rely on announcements made by crew members. This, of course, would pose problems for travellers with auditory disabilities.

6.5 Guidelines for Planners and Designers

For more detailed information on adequate safety measures, planners and designers should consult:

- Sections 3.3 and 3.5 for pedestrian crosswalks and human factors in design;
- Section 5.2 for communications media and technology;
- Section 7.7 for staff training programs;
- Section 17.2 for multimodal travel requirements;
- Canadian Standards Association CAN/CSA-B651-95 on *Barrier-Free Design* and CAN/CSA-Z321-96 on *Signs and Symbols for the Workplace;*
- Canada Safety Council's numerous publications on safety issues, including the 55 Alive program;
- National Safety Council's (Chicago) numerous publications on pedestrian and automobile safety issues, including the Walk Alert program;
- Provincial and municipal safety councils;
- Carriers that have developed specialized accessibility technology, including airlines, GO Transit, VIA Rail, and the urban transit and paratransit systems in major cities.

6.5.1 Pedestrian Safety

Seniors and persons with disabilities need the following to cross traffic streams safely:

- adequate time to cross roadways equipped with traffic signals;
- barrier-free design;
- proper orientation at crosswalks;
- accurate information;
- simplified education or training in how to use pedestrian traffic systems.

Pedestrian safety programs should draw on the experience of national safety programs and the training programs offered by occupational therapists. Safety programs should convey the following advice to pedestrians:

- cross only at crosswalks;
- look carefully for vehicles, including bicycles and motorcycles, when crossing;
- cross where there is a median island or refuge if possible;
- if at all possible, avoid going outdoors when the conditions are icy or snowy;
- carry or wear something conspicuous (reflective or white) if you cannot avoid going out in the dark or in poor light;
- allow plenty of time for the journey;
- do not cross near parked cars;
- carry a white cane if eyesight is a problem;
- cross via a pedestrian overpass or underpass if available;
- avoid peak traffic hours;
- avoid crossing more roads than really necessary.

The Vancouver Safety Council helped to create an excellent booklet, on *Getting Around (Safely) on an Electric Wheelchair or Scooter*. The publication is available for $6.00 from Ranger Scooters Ltd., 101-17707 56th Avenue, Surrey, British Columbia, V3S 1C7, telephone or fax (604) 576-8488.

6.5.2 Passenger Safety

Designers of safety programs should consider the following:

- A tactile map showing a comprehensive layout of the interior of the vehicle should be available to passengers who request it.
- Signs indicating washroom doors and emergency exits should be improved.
- Colour-contrasted borders should be placed around emergency exits.

- Alternatives to overhead storage locations should be available and pointed out to travellers with visual impairments.
- Information systems should be designed to accommodate travellers with sensory and cognitive disabilities.
- Accessible information systems should be used to supply pertinent information that is not currently available to persons with disabilities.
- Information should be provided in several modes (print, visual display, audible, and tactile).
- Public announcements should be made during emergencies to instruct passengers on emergency procedures. Captions and graphic displays should be provided on video screens to augment the auditory announcements.
- Attendants should be given sensitivity training so that they can accommodate passengers with special needs during stressful periods such as emergencies.

Table 6.2 lists the major human factors to take into account when designing an emergency evacuation system. The factors are related to specific disabilities and to system design features that should help users of emergency systems (Nicodemus and Webster, 1980).

Intercity Buses

- Flashing lights and alarm bells should be placed near emergency roof exits to make them easier to locate.
- The mechanism and instructions for opening roof exits should be greatly simplified. Use easily interpreted pictograms and arrows instead of words, which may be complicated (see Chapter 5).
- Emergency procedures, including clear instructions on how to evacuate via emergency exits, should be incorporated into a safety video, an information brochure, and an information cassette.

Aircraft

- Life jackets should be redesigned so that they are easier to fasten.
- Tactile wayfinding cues should be provided to help persons with visual disabilities find emergency exits.
- Pre-boarding briefings should be given individually, where possible, and should include location of washrooms and emergency exits. Passengers with visual disabilities should be told how many rows they are from the washroom and emergency exit.
- Emergency evacuation information should be available in a brochure and in an auditory mode.

Table 6.2 Human factors in evacuation design

Functional Considerations		System Design Features
Mobility	Move or propel oneself horizontally or vertically	Safe areas close enough to enable survival for 4 minutes in a smoky environment
Agility	Physically operate controls of various kinds	Extremely simple controls placed within 1 m of floor level and operable by gross motor activity
Hearing	Detect audible alarms and follow audible instructions	Visual and tactile alarm systems
Seeing	Detect visual alarms and follow visual instructions	Audible and tactile alarms and instructions
Perception	Understand controls and instructions (despite language barriers, lack of education, learning disability, developmental disability, or loss of mental integrative capability)	Non-language-specific instructions and control directions; clearly understandable symbolic instructions; psychologically appropriate controls (e.g., in an emergency, a person needs to push on a door, not pull on it)

(Nicodemus and Webster, 1980)

Urban Buses

- Emergency exits should be highlighted with colour-contrasted borders. Floor signs should indicate that an emergency roof exit is overhead.
- The mechanism for opening a roof exit should be single action.
- The signs instructing passengers on how to open emergency exits should be improved.
- Emergency evacuation information should be available in a brochure and in an auditory mode.
- Drivers should be given enhanced sensitivity training to teach them how to accommodate the special needs of passengers during stressful periods, such as emergencies.

Urban Rail

- Signs should be easily seen by both seated and standing passengers.
- Electronic procedures and systems should be explained in an information brochure and on an information cassette. Emergency systems should be well publicized.
- Emergency strips should be designed to depress significantly, activating a light that confirms the signal has been received by the control station.

Intercity Rail

- Public address announcements should be made during emergencies to instruct passengers on procedures. Video should be captioned to augment auditory announcements.
- Rail personnel should be given enhanced sensitivity training so that they can accommodate the special needs of passengers during stressful periods, such as emergencies.

Ferries

- Real-time captioning on video monitors should be used to augment the auditory information provided over the public address system.
- Captioned safety videos should be shown at the start of each ferry trip.
- Designated courtesy seating should be provided for passengers with disabilities; this would also assist the crew in identifying passengers who may require special assistance during an emergency.
- Nautical language should not be used in announcements during an emergency.
- Flashing lights should be used to warn passengers of emergencies.
- The ferry plan should show the location of all emergency equipment.
- The crew should wear distinct uniforms so that they can be easily identified.
- All personnel should be sensitized to the special needs of passengers with disabilities.

- 7 -

TRAINING

– 1 – INTRODUCTION

CUSTOMER ACCESS

– 2 – TRIP PLANNING	– 3 – ROADWAYS & TERMINALS	– 4 – PERSONAL VEHICLES

SYSTEM ACCESSIBILITY

– 5 – COMMUNICATIONS SYSTEMS	– 6 – SAFETY & RELIABILITY	**– 7 – TRAINING**	– 8 – RESEARCH & DEVELOPMENT

PUBLIC CARRIERS: LOCAL

– 9 – ACCESSIBLE TAXIS	– 10 – URBAN BUS SYSTEMS	– 11 – URBAN RAIL SYSTEMS	– 12 – RURAL SYSTEMS

PUBLIC CARRIERS: INTERCITY

– 13 – AIR TRANSPORT SYSTEMS	– 14 – INTERCITY RAIL SYSTEMS	– 15 – INTERCITY BUS SYSTEMS	– 16 – MARINE SYSTEMS

– 17 – MODAL INTEGRATION

7 Training

Most public carriers provide some form of sensitivity training, often as an extension of their customer relations and marketing programs. Rail, marine, and air carriers, as well as terminal operators under federal jurisdiction, are required to ensure that their employees and contractors are properly trained to serve customers with disabilities (MacDonald, 1995). This chapter describes some of the unique approaches to training that are used to develop an appreciation of the special needs of seniors and persons with disabilities when using Canadian transportation systems.

This chapter discusses only training that is unique to transportation organizations and is not readily available from educational institutions and commercial sources. It includes sources of specialized training assistance for the delivery of accessible transportation services and references to in-house training programs.

In the past, training programs have attempted to sensitize carrier staff to particular disabilities and their effects on customer-to-carrier communications. However, a tendency to diagnose a disability from appearance and behaviour has proven to have serious shortcomings:

- The short interval that a carrier attendant is in contact with a customer is rarely sufficient for a diagnosis, even if the attendant is thus qualified.
- Most disabilities are not obvious and may only become visible when a customer has difficulty in boarding or is unable to gain access to the service.
- Many customers are affected by more than one disability or factor that may place limitations on their ability to travel.
- Most customers with disabilities, like other customers, are healthy, independent, competent, and intelligent people who have learned how to compensate for their functional limitations (Health & Welfare Canada, 1988).

7.1 Scope of Training

Within any transportation system, the needs of six main employee groups should be considered in a comprehensive training program. Each group has individual skills, knowledge, and behavioural training requirements. All need a high degree of communications skills and effectiveness in working together as a team.

- Senior management require the sensitivity awareness, leadership skills, and knowledge to formulate strategic plans and to conceptualize corporate goals and objectives, policies, and performance standards. Senior management also need human-relations skills and sensitivities for communicating with staff groups, the media, the public, regulatory agencies, and elected officials.

- Middle management must implement the strategic plans and objectives set by senior management, as well as handle day-to-day human-relations and technical problems that arise in the operation of a transportation system.
- Supervisory staff require the skills to direct the technical functions for which they are responsible. They also need the human-relations skills to deal effectively with their operating and maintenance personnel, who are often bound by a collective agreement.
- Operating personnel require the knowledge and technical skills to implement company policies and procedures for the safe, reliable, and courteous operation of transit vehicles. Human-relations skills are particularly important when dealing with passengers.
- Maintenance personnel require the knowledge and technical skills to carry out company policies and procedures relating to the maintenance of vehicles and related facilities.
- Administrative staff require technical knowledge and skills to provide support to all levels of management and supervisory personnel, and customer-relations skills when dealing with the public.

The following factors should be considered in selecting, developing, and managing a training program.

- **Objectives:** Training objectives must describe the intended results. Objectives provide a sound basis for selecting and designing course content and procedures, evaluating the success of the instruction, and organizing the learner's own efforts and activities to accomplish the training goals.
- **Instructors:** Instructors must be selected carefully and should have adult-education experience, as well as sufficient skills and training to carry out their responsibilities. Specific skills in human relations, development of presentations, effective communication with a diverse work force, and leading discussions are required, in addition to knowledge and experience of a particular transportation mode. The instructor is also a role model. Often a new employee's first formal contact with an organization, the instructor can influence that person's perception of or attitude towards the organization.
- **Training formats and processes:** An appropriate mix of training formats must be used to achieve training objectives. Formal lectures, audio-visual presentations, question-and-answer sessions, group discussions, hands-on practical sessions, demonstrations, and workshops can all be used. Many transit systems have found it invaluable to bring in people with various disabilities as part of the training team when providing training and retraining for bus drivers.

Workshop sessions should be long enough to cover the necessary material at a pace that helps comprehension, but should not include non-essential or repetitive

material. The organization of training programs into discrete modules makes learning easy, especially if the modules are spaced to allow for adequate review and practical application. Allow time for evaluation and follow up.

- **Prepared material:** Instructors and participants will benefit from the development of and adherence to a leader's guide prepared for the course. As well, course participants should be provided with suitable reference materials relating to the key concepts of the course for individual study.
- **Class size:** Class size should be limited to encourage involvement. With more than 12 participants, participatory training is very difficult.
- **Training environment:** Classroom facilities should be relaxed, informal, and free from external distractions. The immediate environment should allow participants to isolate themselves from their job responsibilities to concentrate on learning. The classroom should be comfortable, ergonomically designed, and equipped to encourage interaction.
- **Management support:** Post-training support, reinforcement, and encouragement by management and supervisors are critical if newly learned skills are to be successfully applied on the job.

7.2 Customers with Special Needs

7.2.1 Customers with Disabilities

Transport Canada defines a person with disabilities as "any person who has a physical, mental, or medical condition, either permanent or temporary, that limits their ability to use public transportation services". The World Health Organization's definition of a disability is "any restriction or lack of ability to perform an activity in the manner or within a range considered normal for a human being" (Hickling-Partners, 1982).

Currently, approximately 4 million Canadians, 42 million Americans, and more than 40 million Europeans have disabilities. This clientele, along with an aging population, contributes to the growing demand for accessible and integrated transportation. The TransAccess™ Information Base contains data on 3.8 million adult Canadians with disabilities who are living in households (Goss Gilroy, 1995a-e).

7.2.2 Seniors

Disability rates increase with age. As people age, their bodies go through complex changes, which do not occur at the same rate or level of severity for everyone. Many persons who do not have an apparent disability are affected by the aging process in various ways.

- **Vision and perception:** Any reduced ability of the eyes to focus and the effects of astigmatism, macular degeneration, or glaucoma may reduce the ability to see clearly.
- **Hearing:** Partial loss of hearing, especially at higher frequencies, is common with increasing age and makes it difficult to understand public address system messages. The ear also plays an important role in maintaining balance.
- **Motor and psychomotor capacity:** Loss of muscular strength and muscle tone lead to balance problems and spatial disorientation.
- **Pathological changes:** Conditions found more commonly among seniors may produce reduced cognitive abilities (forgetfulness), cardiovascular problems, or osteoarticulatory disorders such as hip/knee problems. Problems may arise from chemotherapy, overuse of medications, or the effect of multiple drugs.
- **Cognitive changes:** The brain's capacity to filter out background noise declines with advanced age. The ability to process information is slowed and short-term memory is affected.

Although the above limitations may not add up to a disability, they do affect seniors' ability to travel.

7.2.3 Persons with Ability to Travel

Disabilities are not all the same and functional capabilities vary greatly. For example, two people with the same condition and degree of severity may have quite different capacities to use a given transport mode.

The most prevalent types of disabilities affect mobility and agility. More than 50 percent of all disabilities are of this type, although less than 10 percent are severe enough to require the use of a wheelchair or other mobility device. The other types of disabilities, by order of prevalence, affect hearing, vision, and speech.

Approximately 57.5 percent of people with disabilities (9.9 percent of the total population) have problems using transportation. The personal vehicle is by far the most popular mode of transportation. Canadian data show that travellers with disabilities use personal vehicles for 88.7 percent of long-distance trips (Goss Gilroy, 1995a).

The number of persons who use public transport varies with availability, location (urban or rural), eligibility criteria for paratransit, and the availability of service subsidies. Conventional transit is available to ten times as many people as special transit, and, with the increase in the number of systems with low-floor buses, provides an alternative for ambulatory travellers with disabilities.

7.2.4 Facilitating Travel

The Edmonton Transit System has developed a unique training package to help customers choose from the various transit options available. The package, called *Mobility Choices*, includes an instructor's manual, a customer notebook, and an illustrative video. Customer service representatives conduct workshops with small groups of transit customers. Detailed information is provided on the accessibility features of rail, low-floor bus, and paratransit services. Edmonton Transit expects to derive several benefits from this program, including encouraging customers to shift from the more costly paratransit service to accessible fixed-route services (Edmonton Transit, 1995a). For information on this program contact:

Special Projects Coordinator
The City of Edmonton
Transportation Department
15th Floor, Century Place
9803 – 102A Avenue
Edmonton, Alberta
T5J 3A3

7.3 CUTA Training Programs

The training programs developed by the Canadian Urban Transit Association (CUTA) are designed to supplement basic in-house and external training programs provided for management and staff at most transit systems. Some CUTA programs provide a coordinated approach to the six main employee groups described in Section 7.1. Others support the ongoing updating of skills needed to address new technology and new public issues (CUTA, 1995).

CUTA's implementation strategy is based on research showing that to transfer learning from the classroom to the job requires certain conditions:

- The organization's power structure must be involved and visibly committed to the learning objectives;
- The trainee's immediate superior (the key person involved) must support the process and know how to reinforce learning;
- The course content must be relevant and specific to the trainee's job.

7.3.1 Operators for Parallel Transit Services

This sensitivity program is designed to train as well as to screen people who want to be operators for special transit services. Ideally, candidate drivers have already been carefully screened and selected. This course, however, helps people who bid on a position, thinking it an easy job, to reconsider honestly their suitability for this type of work, and gives them an opportunity to withdraw gracefully, if appropriate (Behavioural Team, 1988).

Attendees gain inside information on five elements of parallel transit (also called paratransit):

- The Role of the Operator
  - an introduction to the principles and history of parallel transit services, including the employee organization
  - customer relations
- The Range of Abilities
  - recognizing common disabilities
  - transporting persons with disabilities in comfort and safety
  - methods of assistance, and precautions needed
- Positive Attitudes to Helping Passengers
  - positive attitudes towards customers with disabilities
  - introduction to assisting passengers
- Summary and Review
  - teamwork, knowledge, and techniques
  - importance of dedicated operators
- Special Supplement
  - *Good Riding for Everyone* is a 10-minute video intended to acquaint customers of parallel transit systems with basic principles of how the system functions and the need to communicate with the driver

7.3.2 Transit Ambassador Program

The Transit Ambassador Program is a customer-service training package designed to give transit employees skills and concepts to improve customer relations significantly and to assist management in developing a strong internal commitment to teamwork and customer service. There are custom versions in English and French for bus and rail services. The 10 modules of the program include the following topics:

- Module #1: Fundamentals
  - awareness, and understanding the importance of customer service
  - professionalism
  - "value added" service
- Module #2: Communications
  - blocks to effective communication
  - reading body language
  - interpreting tone
  - speaking effectively
  - asking questions
  - paraphrasing
- Module #3: "Your Attention Please"
  - public announcement skills
  - routine, non-routine, and emergency situations
  - using the Landset (microphone)
- Module #4: Special Needs
  - identifying "cues"
  - how to offer assistance
  - use of diplomacy and intuitive skills
- Module #5: Complaints or Opportunities
  - turning complaints into opportunities
  - verifying understanding
  - providing a resolution
  - avoiding future occurrences
- Module #6: Difficult Situations
  - passenger rule infractions
  - fare and transfer disputes
  - active listening
  - maintaining safety
- Module #7: Stress
  - explanation of stress
  - how stress affects performance
  - recognizing symptoms
  - stress-handling techniques
  - lifestyle
- Module #8: Management Support
  - understanding and supporting the values of the Transit Ambassador
  - giving recognition
  - coaching

- Module #9: Everybody's Business
  - teamwork and interdepartmental relations
  - true customer orientation for all employees
  - recognizing other employees as "internal customers"
- Module #10: Review
  - evaluation of personal skills
  - review of what was learned
  - renewing commitments

7.4 Training for Operators of Accessible Buses

A substantial number of specialized training manuals and guidelines have been developed to help train operators of paratransit systems and services (for example, Alberta Transportation, Ministry of Transportation of Ontario, BC Transit, CUTA, Ontario Urban Transit Association, Transport Canada, and Toronto Transit Commission all use such training tools). As conventional transit systems have become more and more accessible, these training techniques have been incorporated into regular operator training programs.

BC Transit has developed such a program to help with the increased number of accessible buses in the Vancouver Region. The training package includes detailed instructions on equipment, wheelchair securement, and passenger belt restraints. The various types of mobility devices are discussed, as well as safety issues, emergency procedures, and reporting incidents and complaints (BC Transit, 1995). For information on the BC Transit training programs contact:

Director, Accessible Transit and Contract Services
BC Transit
13401 – 108th Avenue
Surrey, B.C.
V3T 5T4

7.4.1 Special Technology

This element of the training program should familiarize trainees with the various types of specialized equipment they will encounter and the importance of using it. They should learn the proper techniques to use when assisting passengers to board and alight from the vehicle.

Disability resource centres, such as rehabilitation centres and hospitals, have access to various devices and have a high level of expertise in assisting individuals with disabilities. A liaison between such resources and transportation operators is strongly recommended. Drivers should be familiar with all aspects of the following:

- wheelchair securement and passenger-restraint systems
- lift and ramp operation
- wheelchairs and other assistive devices
- assisting passengers who use wheelchairs and ambulatory riders only when help is needed

7.4.2 Administrative and Operating Procedures

Drivers must be familiar with the administrative and operating procedures associated with the system. Special attention must be given to radio communications, routing and scheduling, emergency procedures, first aid, and pick-up/drop-off/no-show policies, if applicable.

7.4.3 Driving Techniques

Smooth vehicle operation is extremely important in transporting seniors and persons with disabilities. Many passengers have poor balance, slow reflexes, and weak muscle control and are, therefore, especially vulnerable to sudden starts and stops. Braking, acceleration, and cornering should be as smooth as possible. Bus operators should be trained to execute flat turns, especially when turning left.

7.5 Training for Taxi Drivers

Because taxis are so important for travellers with disabilities, specialized training for new drivers has become essential, even mandatory in many municipalities. Experienced drivers may need to take upgrading courses.

The Ministry of Transportation of Quebec (MTQ) has developed three such training courses: driver safety and public security; paratransit; and customer reception and service, which has the objective of accommodating tourists.

The Ontario Urban Transit Association (OUTA) Centre for Transit Improvement has developed a sensitivity-training package and CUTA has a driver-training video in both English and French.

7.5.1 Taxi Driver Training Programs in Quebec

Quebec is the only province to regulate taxis on a province-wide basis (see Section 9.2). Training for new drivers has been mandatory (before a licence is issued) since 1990. There are also upgrading courses for licensed drivers. The basic training is aimed at all taxi drivers regardless of the territory they serve; the responsibility of making it mandatory to learn local content is left to regional authorities (RUTASM, 1990; Trudel, 1993).

TDC and the MTQ co-sponsored the development of a taxi driver training kit in English and French, consisting of an eight-module vocational training program, 50 to 60 hours in length. Table 7.1 summarizes the subjects covered. This basic training is mandatory for new taxi drivers planning to work in the urban communities of Montreal and Quebec, and in Laval and Longueuil. In Montreal, the regional partners chose to add 90 hours of territorial knowledge training to the basic program. A private training institution (Association québécoise des intervenants du taxi) provides the training in Montreal, while public institutions specializing in driver training offer courses in Charlesbourg and St. Jerome.

7.5.2 The OUTA Sensitivity-Training Package

The basic, four-hour training package includes:

- a facilitator (instructor) guide
- a driver reference manual
- two classroom wall charts
- an introductory video for taxi drivers
- certificates of completion
- course-evaluation and driver-information forms
- reference materials on helping people with disabilities

The course includes the CUTA special operator training video to illustrate the various mobility devices and sensitivity-training techniques. The complete package, including the CUTA video, costs $100.00 and may be ordered from:

Ontario Urban Transit Association
55 York Street, Suite 901
Toronto, Ontario M5J 1R7
Telephone: (416) 365-9800
Fax: (416) 365-1295

Table 7.1 **Vocational training for taxi drivers in Quebec**

Modules	Time Distribution	
	%	Hours
Introduction to the taxi industry: Principal parties: Powers and functions Legislative and regulatory context	25	12.5
Professional ethics – conduct and image of taxi drivers: Customer relations Relations with co-workers Public relations	30	15.0
Safety: Driver safety Passenger safety	5	2.5
Use of equipment: Vehicle Taximeter Radio Identifying signs Security system	8	4
Paratransit: Different disabilities and associated behaviour Methods of approach and action Roles of driver and dispatcher	15	7.5
Management ideas for the independent driver: Situation of the self-employed driver Bookkeeping and taxation Legal issues in the taxi business	10	5
Work territory knowledge	5	2.5
Information and documentation available	2	1
TOTAL	**100**	**50**

(Trudel, 1993)

7.6 Awareness Training for Carrier Staff

Canadian Transportation Agency (CTA) regulations require that employees and contractors of federally regulated carriers and their terminal operators who make decisions about people with disabilities know the carrier's or terminal operator's policies and procedures. In addition, they must receive general sensitivity training to be able to identify and respond to the needs of travellers with disabilities.

For more information contact:

Accessible Transportation Directorate
Canadian Transportation Agency
Ottawa, Ontario K1A 0N9
Telephone: 1-800-883-1818, or (819) 997-6828
TTY/TDD: 1-800-669-5575, or (819) 953-9705

Transport Canada has provided funding to help carriers meet the above requirements. A number of public transportation carriers have taken advantage of this funding for awareness training ("Update", 1995).

The following are examples of programs that were developed with the help of this funding.

7.6.1 Airline Programs

Air Canada's training program, *Serving Customers with Disabilities,* was developed by people with disabilities who work for Kéroul, a company specializing in tourism for people with restricted mobility (Poole, 1995). The sensitivity-awareness training module is presented by a person with a disability. All Air Canada instructors were trained by Kéroul. The training included a two-hour experience where participants did errands in downtown Montreal in a wheelchair (Stanyer, 1996).

Partially funded by Transport Canada, the intensive four-hour training session instructs in-flight, ramp, customer sales, and customer service personnel, and customer service managers on how to assess and respond to the needs of customers with disabilities. Employees also learn how to help customers who require assistance in moving around the airport, boarding an aircraft, or transferring between terminals. Air Canada's objective in developing this training program is "to give customers with disabilities a travel experience equal in comfort and convenience to that offered to other passengers".

For information on the Air Canada training programs contact:

Government Relations Coordinator
Air Canada
20th Floor, 275 Slater Street
Ottawa, Ontario
K1P 5H9
Fax: (613) 783-7143

The contractor's address is:

Kéroul Association for the Development of Tourism for
People with Physical Disabilities
4545 Pierre-de-Coubertin Avenue
P.O. Box 1000, Station M
Montreal, Quebec
H1V 3R2
Tel: (514) 252-3104; Fax: (514) 254-0766

7.6.2 Rail Programs

Handidactis, a Montreal-based, non-profit organization, helped VIA Rail produce a video featuring actors with disabilities and VIA Rail customer-service employees. In the video, the actors discuss their disabilities, how they have learned to live with them, and what others can do to help them. They then act out a scene in which a VIA Rail employee assists them. A brief text on the screen outlines the steps an employee should take in a similar situation. Handidactis also helped VIA Rail develop the instructor's program and delivered two intensive sessions (one in English, one in French) to VIA Rail's training instructors who present the course to front-line employees.

VIA Rail undertook a cross-country training blitz in 1994-95 to help employees deliver a high-quality service to persons with disabilities. More than 1,200 employees participated in 1995.

7.6.3 Intercity Bus Programs

With financial assistance from Transport Canada, the Canadian Bus Association developed a special awareness-training program for drivers of intercity buses. A similar program was developed in 1994 for charter bus operators (B. Clark Associates, 1995). For information on these programs, contact the Canadian Bus Association or the Ontario Motor Coach Association.

7.6.4 Other Specialized Programs

An innovative awareness-training program was developed at the Calgary International Airport to improve services to travellers with special needs.

It focuses on four main topics: physical mobility, hearing loss, vision loss, and seniors. The program manual also deals with cognitive disabilities and how to use appropriate language. Presenters are knowledgeable consumers with first-hand experience in what they are teaching. Participants learn how to respond courteously to travellers with special needs and how to ensure that they are not submitted to indignities. The sessions and manuals are intended to augment or complement existing sensitivity training provided by employers.

The modular program, a collaborative project of the Calgary International Airport, Deaf and Hard of Hearing Services (Calgary Region), and Transport Canada, is free to participants and open to anyone who works in the airport community.

7.7 Guidelines for Planning Training Programs

The current approach to assisting customers with disabilities is to observe and listen carefully and to give all customers the opportunity to request assistance if it is needed. Well-trained, professional staff will respond appropriately to a need or know where to obtain assistance and redirect a customer. The following example illustrates some of the many factors that could cause an incident.

A customer arrives at a transportation terminal check-in and appears confused and uncertain. Possible reasons for this behaviour are that the customer:

- is not a regular customer and therefore is unfamiliar with the layout of the facilities and the services offered;
- does not understand the primary Canadian languages;
- did not allow sufficient time to access the service and is panicking;
- is lacking sufficient sleep;
- is dehydrated;
- is on medications with side effects or has taken incompatible medications;
- is a substance abuser;
- is under stress (e.g., temporary or permanent stress and/or pain);
- is over- or under-nourished (e.g., too much or too little blood sugar);
- has a cognitive disability;
- has an impatient personality;
- has a physical disability (e.g., poor hearing).

7.7.1 Guidelines for Carrier Attendants

Attendants should be knowledgeable about the carrier's service policies and availability, and they should be prepared to assist the traveller if required. They should introduce themselves and offer assistance, but they should not feel offended if their help is not needed. They should be courteous, but not condescending. The following guidelines apply:

- Always ask the customers if they need help.
- Assist customers with disabilities when they request it or it becomes necessary, and do not discourage their active participation.
- Allow customers to do what they want to do for themselves.
- Treat people as you would like to be treated yourself.
- Speak directly to the person with a disability, not to a companion or attendant.
- Recognize that people with disabilities are not all alike and have a wide variety of skills and personalities.
- Carefully evaluate the amount of assistance needed. In some cases, additional personnel could be required to ensure the safety of customers and staff.
- Some passengers who appear robust may be quite fragile; treat them with care and do not rush them.
- Seemingly healthy passengers may be subject to dizziness and falling, so watch carefully, particularly if they are attempting to move about in a vehicle in motion.
- Some passengers may express themselves slowly and with difficulty, so be patient. Alternative communication systems may be required.
- Some persons with disabilities have at some time in the past experienced well-intentioned but clumsy help that caused them pain and distress. Expect to have to win the passenger's trust by consulting with them. It is best to negotiate a plan before acting.

7.7.2 Guidelines for Assisting Passengers in Manual Wheelchairs

Recognize that a wheelchair is part of the user's personal space; it is not a leaning post. Check that the wheelchair is in proper working order. Are brakes, handgrips, and arm and foot rests secure? Is the seatbelt fastened? Make sure the route is planned and accessible.

- Do not grab the chair, move suddenly, or travel too fast.
- Discuss all movements prior to assisting the customer.
- Speak loudly enough to be heard.

- Whenever possible, speak face to face, at eye level. If speaking in a group, include everybody.
- Always apply the wheelchair's brakes when it is parked or when a customer is moving in and out of the wheelchair.
- Watch where you are going.
- Avoid uneven floors, doors that open outwards, bumps, spills, wet floors, and elevator drops and rises.
- Be careful in crowds; avoid following too closely or turning too quickly.
- Step on the wheelchair rear tipping bar for leverage when tilting back to lift front wheels for curbs, stairs, and uneven ground.
- Approach curbs and thresholds squarely. To go up, tip the wheelchair back using the tipping bar and position both front wheels atop the curb. Lift the rear of the chair by hand grips and push the rear wheels onto the curb. Roll down a curb with back wheels first.
- Do not attempt steep inclines unless you are sure you can hold the weight of the person and maintain full control. Going down backwards is usually safer (Figure 7.1).
- Do not attempt to climb stairs unless you are sure you can hold the weight of the person and the wheelchair and still maintain full control.

Figure 7.1 Descending a ramp with a person in a wheelchair
(Ann Finlay, O.T., M.Ed.; graphics by Maria George)

If a traveller in a wheelchair is to be lifted, at least two people are needed to pull the chair (Figure 7.2). Attendants should position the wheelchair squarely at the foot of the stairs with the passenger's back towards the steps and tip the chair back until it feels balanced. They should keep their knees bent and tighten their stomach muscles; use their legs – not their backs – for strength; and pull against each step. One or two other helpers should stand in front for safety to steady and guide the chair (holding the chair frame, not the arm or foot rests) as it moves up or down over each step, until both the rider and the chair are in a safe and secure position.

Figure 7.2 Climbing stairs with a person in a wheelchair
(Ann Finlay, O.T., M.Ed.; graphics by Maria George)

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RESEARCH AND DEVELOPMENT

– 1 –
INTRODUCTION

CUSTOMER ACCESS

– 2 – TRIP PLANNING	– 3 – ROADWAYS & TERMINALS	– 4 – PERSONAL VEHICLES

SYSTEM ACCESSIBILITY

– 5 – COMMUNICATIONS SYSTEMS	– 6 – SAFETY & RELIABILITY	– 7 – TRAINING	**– 8 – RESEARCH & DEVELOPMENT**

PUBLIC CARRIERS: LOCAL

– 9 – ACCESSIBLE TAXIS	– 10 – URBAN BUS SYSTEMS	– 11 – URBAN RAIL SYSTEMS	– 12 – RURAL SYSTEMS

PUBLIC CARRIERS: INTERCITY

– 13 – AIR TRANSPORT SYSTEMS	– 14 – INTERCITY RAIL SYSTEMS	– 15 – INTERCITY BUS SYSTEMS	– 16 – MARINE SYSTEMS

– 17 –
MODAL INTEGRATION

8 Research and Development

Appropriate technology and supporting systems are critical to the successful implementation of accessible transportation. Research and development (R&D) plays a key role in championing the development of new and improved solutions to accessibility problems.

The opportunities for the development of specialized products and services to improve the mobility of people with disabilities are unlimited. The products range from low-cost devices that enhance personal communications and mobility to highly sophisticated devices designed to enhance or substitute for sensory functions. When responding to these opportunities, designers and developers should be guided by the following observations:

- Products and services are usually designed for mass markets so that the unit cost does not become a barrier to individual mobility. This presents a serious challenge to designers because of the conflicting needs of persons with different types of disabilities and the needs of persons with multiple disabilities.
- Mobility aids and devices must be portable. Their use should not make travel more difficult. For example, wheelchair controls or a cane, a service animal, a monocular, or a computer access device may occupy one or both arms of a person; it is easy to imagine the pressure on a traveller with disabilities.
- Feeder and line-haul transportation systems should be better integrated.
- Technology should be standardized. Because of the variety of mobility devices, it is difficult at present to safely accommodate all persons on transportation vehicles.
- Planning and designs that meet the needs of persons with cognitive disabilities require more research. It is not clear how well these people are being served by existing techniques.
- The best technical designs appear to be the simpler approaches. For example, a low-floor bus eliminates the need for complex lift technology. It is easier to comprehend, faster to board, has fewer in-service failures, and requires less maintenance than traditional buses.

8.1 The Development Process

If transportation R&D is to respond effectively to consumer needs, government, industry, consumers, and educators must join in a collaborative effort. The following five steps would help to focus energies and resources:

- Definition of needs: Identify system requirements and develop specifications.
- Concept definition: Define the problem, develop alternative concepts, evaluate alternatives, select the best concept(s) for design, and structure the follow-on work required. Define the approval process required.
- Design phase: Prepare preliminary design(s) in sufficient detail for evaluation. Evaluate the design from several points of view, including compliance with standards, ergonomic suitability for passengers and operators, safety issues, lifetime costs, reliability, maintenance required, space requirements, ease of operation, and appearance. Complete the detailed design and obtain the necessary approvals.
- Prototype manufacture: Develop a prototype for field testing. Field test and evaluate for mass production.
- Demonstration: Demonstrate and evaluate the prototype.

8.2 Federal R&D Activities

8.2.1 Transportation Development Centre

The historical role of the Transportation Development Centre (TDC) in transportation R&D was described in Section 1.3.3. The emphasis has been on eliminating barriers in the entire transportation chain, including vehicles, terminals, pedestrian and automobile access, and the related information and communications systems. R&D projects managed by TDC have focused mainly on the following areas:

- information and communications technology
- bus transportation technology
- boarding systems and ground transportation at terminals
- technology transfer
- training and outreach
- the national disability information base
- development of national voluntary standards and technical guidelines

8.2.2 Other Federal Agencies

Other federal agencies such as Parks Canada, Industry Canada, the National Research Council, and Natural Resources Canada are often involved as co-sponsors of TDC's R&D projects.

Federal agencies such as the National Advisory Council on Aging, the Seniors Independence Program of Health Canada, Western Economic Diversification

Canada, Statistics Canada, and the National Literacy Secretariat have also sponsored research projects on the needs of seniors and persons with disabilities.

8.3 Provincial and Territorial Activities

With the exception of Saskatchewan, Newfoundland, New Brunswick, and the Northwest Territories, provincial and territorial jurisdictions have a program for urban transit assistance funding including R&D projects (Canadian Urban Transit Association, 1993). Saskatchewan, New Brunswick, and the Northwest Territories have assisted rural communities to implement accessible transportation systems and contributed to specific projects.

Most of the R&D projects are being carried out by Alberta, British Columbia, Ontario, and Quebec. Recent and ongoing projects include:

Alberta

Alberta Transportation and Utilities has sponsored several projects under its Barrier-Free Program:

- Defining the role of accessible taxis in urban and rural transportation;
- Developing a training manual for drivers of accessible vehicles;
- Developing retractable boarding ramps for light rail transit vehicles (Calgary and Edmonton);
- Demonstrating a low-floor articulated transit bus in Strathcona County;
- Demonstrating an accessible intercity bus (Calgary, Red Deer, Edmonton);
- Developing guidelines for a safe accessible pedestrian environment, including bus stops and on-street transfer terminals.

British Columbia

- Testing and deploying accessible transit buses;
- Evaluating full-sized, low-floor, urban buses versus lift-equipped buses (BC Transit);
- Implementing a new accessible commuter rail system.

Ontario

- Providing 90-percent funding for tests of accessibility improvements to urban rail systems in Toronto;
- Developing standards for low-floor bus manufacture;
- Conducting long-term research, development, and demonstrations of new scheduling programs for paratransit services;

- Conducting long-term development of automated vehicle location/communication (AVL/C) systems;
- Developing guidelines for a review of community transportation, including recommendations on service integration, resource pooling, and ride brokerage through a mobility manager;
- Initiating a province-wide program that assists municipalities to develop implementation plans for transit accessibility;
- Demonstrating methods of accommodating mobility devices without securement, such as using rear-facing compartments on transit buses.

Quebec

- Developing taxi driver training and retraining programs;
- Participating in the Ontario AVL/C project;
- Developing standards and guidelines for paratransit systems;
- Developing and demonstrating a prototype low-floor bus made by Nova BUS Corporation;
- Developing accessible commuter railcars.

8.4 Municipal Activities

Municipal R & D activities are primarily concerned with:

- pedestrians (access and safety)
- automobiles (parking, signing, and safety)
- accessible taxis
- urban transit (accessible vehicles and eliminating system barriers)
- integrating terminals and systems

Municipal governments are often partners in research projects supported by the senior levels of government. In such partnerships, municipal governments may loan equipment, modify bylaws, and implement new systems and services to accommodate a particular project.

8.5 The Role of Transportation Associations

Transportation associations such as the Canadian Urban Transit Association (CUTA) and the Transportation Association of Canada (TAC) sponsor technical studies and assist in policy development. Advocate agencies and associations such as the Council of Canadians with Disabilities (CCD) are active in advising governments, industry, and consultants.

8.6 The Role of Industry

Much of accessible transportation technology has been developed through the transportation industry's response to new market opportunities. While government regulation may create the opportunities, the process is driven by consumer demand.

Canadian industry conducts both market and product research, often in partnership with federal and provincial agencies. The major challenge is to identify a sufficient market to justify the capital investment needed to produce the new technology. Because Canada's domestic market is relatively small, market research usually includes international markets.

A review of the role of publicly funded R&D in the development of equipment and practices to assist people with disabilities noted that:

> A study by the Merlin Group, *The Business of Bringing Down the Barriers*, examined the industrial benefits attributable to Transport Canada's accessible transportation program, and concluded that the program substantially benefits industry and the wider Canadian economy, as well as people with disabilities. The study estimated that Transport Canada's total contribution of some $2.3 million to the eight companies investigated created $22.5 million in sales and 322 jobs in 1992. In addition, the study showed that the program would lead to sizable business opportunities in marketing accessible features and systems (Suen and Turnbull, 1995).

8.7 The Role of Consumers

Consumer input is essential for good design. Consumer groups are becoming much more involved in the design of accessible transportation systems. In fact, if they are not invited to participate in the technical studies, they often form their own advisory committees to ensure that their views are heard during the design phase.

Most research agencies plan for the participation of consumers in focus groups, consumer panels, and steering committees. For example, the editorial committee for this guide included representatives from several consumer groups.

8.8 Examples of Recent Projects

8.8.1 Telecite Visual Communication Network

The Visual Communication Network (VCN) was a major development project jointly funded by Telecite Inc., Industry Canada, the National Research Council, and Transport Canada through National Strategy funding and TDC (Bourion, 1992).

The objective was to improve information accessibility for all passengers, including seniors and passengers with sensory and cognitive disabilities. The project included several phases:

- full service installed in the Montreal Metro (begun in May 1993);
- development of a platform version in 1994 for the New York City Transit Authority and the Penn Central railway station;
- demonstration of VCN platform systems in Paris, France, prior to installation;
- application of the platform system in Kansas City's International Airport in 1996.

The results led to an ongoing project to integrate VCN technology with a Global Positioning System (GPS) and fleet management technologies for applications on transit buses. The system has four elements: exterior sign, in-vehicle sign, shelter display, and terminal display.

8.8.2 Adaptation Technology for Vans and Sedans

Joint TDC/industry R&D projects to assist manufacturers in developing or improving adaptation technology include development of the following:

- lift and stowing devices for scooters and electric wheelchairs for accessing vans, trucks, and large automobiles;
- a right-hand portable driving control for rental vehicles;
- a portable automobile and taxi transfer seat;
- a portable mechanical wheelchair ramp system for stairs and level changes;
- a sliding rear-door kit for private automobiles, including station wagons;
- a powered rear-hatch opener for mini-vans and station wagons.

8.8.3 Bus Destination Sign Technology Study

This 1994 study was undertaken for TDC by TransVision Consultants Ltd., with input from MANOP Services Ltd. (Atkinson and Geehan, 1994). The study included a review of the following issues:

- the needs of seniors
- electronic destination sign technology
- distance/illumination/legibility factors

The final report was submitted to the Ministry of Transportation of Ontario's Low-Floor Bus Committee and was also referred to CUTA's Bus Design and Maintenance Committee.

8.8.4 ON/Q *Translaid* Application

This joint development project funded by TDC included the following features:

- a computerized video translation system for making travel reservations;
- provision of eight languages for customers (16 possible);
- the option of English or French for reservation agents;
- provision of visual and auditory cues to augment the text.

The system uses interactive compact disc (Cdi) technology. It was demonstrated at Pearson International Airport by Canadian Airlines in 1995 (see Figure 8.1).

8.8.5 Driving Simulator

This joint undertaking by TDC and Community Therapists Inc. was completed in 1996. The simulator is intended to test the driving ability of seniors and people with brain damage. It features off-the-shelf virtual reality technology configured by professionals in health sciences.

Figure 8.1 ***Translaid* prototype at Pearson International Airport**
(Rutenberg Design Inc.)

8.8.6 Talking Taxi Meter

This TDC-Record Electronics Inc. project developed:

- the design of a talking taxi meter (Smart Speaker);
- an easy-to-read slave unit for passengers in the rear seats of a taxi;
- illuminated LED technology;
- the capability for GPS and Automated Vehicle Location (AVL);
- readiness for messaging, advertising, and an intelligent transportation system.

8.8.7 Tactile Messaging System

This joint project between TDC and Talfourd-Jones developed the design of bus terminal and on-board hardware to help people with visual disabilities. The system includes highly visible non-skid floor coatings and highly visible and padded interior hardware such as:

- bus stanchions
- fare boxes
- stair treads
- coded handrails
- modesty panels
- door messaging panels

8.8.8 Provisions for Service Animals on Regulated Carriers

This study undertaken for TDC by Rutenberg Design Inc. and TransVision Consultants Ltd. included a review of the following:

- provisions for service animals as guides for people with visual and/or hearing disabilities;
- problems encountered during travel;
- particular problems during emergencies or evacuations;
- behaviour of animals in extreme circumstances;
- passenger and carrier awareness of the animal's needs.

8.8.9 Magnetic Fare Card Demonstration

This TDC-sponsored project with Precursor Ltd. included the following:

- developing an automated fare program (Smart Card) system for paratransit and taxis;
- providing such features as
  - voice announcements
  - visual messaging (alphanumeric display)
  - swipe (proximity) credit card transactions
  - fare-splitting capability
  - GPS/AVL capability;
- ensuring compatibility with regular transit system fare-collection devices;
- conducting a demonstration in Burlington and Ajax, Ontario.

8.8.10 Assistive Listening Device for Aircraft

A joint TDC and Assistive Listening Device Systems Inc. project provided these features:

- an infrared communications system for travellers with hearing disabilities;
- installation in terminals or on board aircraft;
- the capability for personal one-to-one communications (e.g., flight attendant to passenger);
- one-to-many communications (e.g., public address);
- no interference with avionics;
- superior sound quality (high-fidelity stereo).

8.8.11 Airport Orientation and Wayfinding

This study, undertaken for TDC by TransVision Consultants Ltd. and Ergo Systems Canada Inc., covered these areas:

- reviewing the needs of travellers who are blind, visually disabled, deaf, hard of hearing, or cognitively disabled;
- identifying and evaluating wayfinding techniques, auditory technologies, and visual displays;
- selecting the best techniques/technologies to meet the needs of the target clientele;
- preparing an implementation plan.

A proposal has been made to demonstrate the techniques developed in this study at Vancouver International Airport.

8.8.12 Accessible Information Guidelines

This TransVision Consultants Ltd. project for TDC included the following elements:

- development of guidelines to improve the accessibility of audio and visual information in transportation systems for travellers with sensory disabilities;
- application to all modes of travel, vehicles, and terminals;
- an outline of the recommended form and content of information to meet existing standards and human-factors guidelines.

8.8.13 Boarding Systems for Small Airports

A joint development project undertaken by Freedom Technologies and TDC featured the following:

- developing a portable mobility lift for use at the smaller and more remote air terminals;
- ensuring reliable performance under all weather conditions;
- using low-cost, off-the-shelf technology that could be truck-mounted.

8.8.14 Boarding Systems for Intercity Buses

Since 1984, TDC has sponsored a series of R&D projects to improve the accessibility of intercity buses. These projects have led to improved bus designs and accessible route demonstrations in the Kingston-Niagara corridor (Palomba, 1993) and in the Calgary-Edmonton corridor. The latter project was a shared-cost government/industry initiative under which Motor Coach Industries Ltd. (MCI) developed, built, and tested a prototype 14 m intercity bus. The MCI project is documented in a TDC report (Naylor, 1992). Information on these projects is provided in Section 15.3.

TDC sponsored the development of the AXIS Boarding System by Questa Design and Engineering Ltd. The AXIS system includes an improved staircase (low-rise stairs), high-visibility yellow handrails, non-skid step treads, improved lighting, and a door that opens a full 90 degrees. The system can be deployed quickly for persons with agility, mobility, and sensory disabilities. It provides for improved boarding for all passengers (Questa, 1996).

8.8.15 Low-Floor Urban Buses

Under its Strategic Transit Research Program, CUTA commissioned two studies: Wheelchair Accommodation and Related Safety Standards for Full Size Urban Buses (Rutenberg, 1993b) and Urban Transit Bus Accessibility Considerations (Rutenberg, 1995a).

The first CUTA study examined safety issues related to passengers who use wheelchairs on transit buses in Germany, which was one of the first countries not only to implement low-floor buses, but also to conduct two significant studies on wheelchair stability and securement design. The conclusion of the German studies was that it is possible to transport wheelchair passengers safely in a transit bus without a securement system if the following conditions are met:

- The wheelchair is placed in a confined space with a back-support panel;
- The wheelchair is facing rearwards with its back in contact with the support panel;
- The brakes of the wheelchair are firmly applied;
- The driver exercises reasonable driving habits;
- The speed does not exceed urban speed limits.

The second CUTA study investigated securement systems and passenger restraints currently in use in Canadian low-floor buses. It also examined other accessibility components such as boarding, manoeuvring, fare payment, stop request, and alighting.

In a 1994 joint project with other manufacturers, Neoplan, a German bus manufacturer, developed the first bus with a low floor throughout. This was achieved by using individual wheel motors, thereby eliminating the rear axle and drive shaft and making a low floor possible throughout the bus. The new urban bus concept is based on the use of the latest electric drive technology and a compact, engine-driven generator.

8.9 Continuing Need for Research and Development

Canada has taken great strides towards making public modes of transportation accessible to persons with disabilities, but much work remains to be done. TDC has played a key role in supporting and complementing the federal government's policy and programs through its commitment to finding new and better solutions to

accessible transportation problems. Even small amounts of funding, provided consistently, have allowed work in accessible transportation to move forward. However, a considerable time lag between the development of a technical solution and its full integration into production vehicles and service seems inevitable.

The transportation initiatives under the National Strategy for the Integration of Persons with Disabilities have led to important improvements to accessibility, particularly for people with mobility disabilities. Travel can be made still more accessible, however, especially for those with sensory (i.e., sight, hearing, and speech) and cognitive disabilities, by applying information technology, which is becoming cheaper and more powerful. R&D must continue if technical solutions to future transportation problems are to be available when needed.

Research results are only effective if they can be applied by transportation providers, who must rank full accessibility among a long list of priorities. For private sector companies, the first priority is profitability, since it determines which improvements may be feasible and when they can be implemented. Most public sector companies require taxpayer support and must allocate approved funding to achieve the greatest benefits for the largest numbers of persons with disabilities. This is particularly true for transport types that have lost ridership in recent years. A joint public-private sector financial commitment to accessibility is imperative before research findings will be effectively applied.

8.9.1 Design Issues, Needs, and Resources

The ability to design accessible transportation systems and mobility devices depends on qualified people equipped with the necessary tools. The human skills exist, largely as a result of participation in the research, development, and implementation efforts by all levels of government during the past 25 years. Many – but not all – the necessary tools exist.

These tools include:

- the national TransAccess™ Information Base on transportation and disabilities (Turnbull and McKenzie, 1995);
- new Canadian Standards Association standards for vehicles and mobility devices;
- Canadian Transportation Agency regulations and guidelines, including the Code of Practice for air, rail, and marine carriers;
- this guide.

Several tools are still needed:

- up-dated catalogues and inventories of accessibility technology;
- systems for monitoring fragmented R&D activities and for disseminating the findings of research work;

- guidelines for designing technology to mitigate conflicts among persons with different types of disabilities;
- more precise guidelines addressing the needs of persons with cognitive disabilities and persons with multiple disabilities;
- further development of design templates, standards, and protocols;
- more detailed statistics and information on motor-vehicle accidents involving persons with disabilities;
- links to information data bases;
- further research on the emergencies that can arise on public transportation vehicles and the information needs of travellers during those emergencies.

8.9.2 Deficiencies in Roadway Signs

Current signs, roadway markings, traffic controls, and highway designs make assumptions about human performance that are becoming increasingly inappropriate for an aging population of drivers. For example, current sign legibility standards in Canada and the United States assume a level of visual acuity that many seniors cannot meet. The current standard – the assumption that a letter 2.5 cm high is legible at 15 m – roughly corresponds to a visual acuity of 20/25, which exceeds the visual ability of about 40 percent of drivers aged 65-74 (the minimum level of acuity required to drive without restrictions is 20/40 in the better eye). Improved roadway signs would help not only older drivers, but all drivers.

8.9.3 The Need for Accessible Taxis

A study in Alberta concluded that the high cost of purpose-built accessible taxis is a major barrier to their deployment (Alberta, 1995a). The study suggests that unless lower-cost, remanufactured vehicles such as the ones used in Vancouver can be produced in quantity, taxi companies are unlikely to purchase accessible taxis.

8.9.4 Standards for Urban Transit Buses

With a move towards setting standards for low-floor transit buses in Canada, several aspects of accessibility must be solved soon, otherwise transit systems may be faced with costly retrofitting in the future.

All accessibility and safety factors in a bus are inter-related (e.g., the service-door position has a bearing on the location of the wheelchair position; the seating capacity affects the securement system). No aspects can be considered in isolation – they must be viewed in terms of the constraints imposed on other elements.

The following research issues are considered important in making access to transit buses more efficient for the transit operators and more convenient for passengers who use wheelchairs and scooters.

- Determine the level of safety for all bus passengers, including standees and persons who use mobility aids, and develop standards (should an equivalent or superior level of safety be provided for persons with disabilities?).
- Investigate reducing or relocating manoeuvring space for passengers who use wheelchairs or scooters so as not to interfere with main passenger flow within a bus.
- Explore German and U.K. developments, which use protected enclosures for passengers in wheelchairs.
- Investigate the placement of wheelchairs and scooters facing forward, rearward, or angled, to provide acceptable safety levels.
- Investigate a design for accommodating mobility aids.
- Make securement adaptable to all commonly used wheelchairs and scooters.
- Investigate the use of a centrally located bus door for wheelchair and scooter access.
- Provide a differentiated signal for stop requests by persons who use wheelchairs. (Some low-floor buses are already equipped with this feature.)
- Reduce the complexity of securement hooks and belts.
- Reduce the driver's involvement in securing mobility aids and giving physical assistance.
- Reduce conflict between the needs of persons with mobility aids and other "priority" persons.
- Improve design and positioning of handrails.

At present, transit operators have a large number of choices in the technology used to accommodate customers with disabilities. Several of these choices require further development and field testing. The issues summarized in Table 8.1 need to be addressed.

Most low-floor bus designers are now providing two assigned locations for passengers using wheelchairs on regular buses. Additional positions will be needed for charter services and group travel.

Trends indicate that future developments on wheelchair securement and passenger restraint systems will focus on one universal system. A concept for a standard interface was developed and evaluated in a 1989 TDC project (Garland, 1989). The data acquired in this work were used by the CSA to develop standards for wheelchair securement and passenger restraint (see Section 6.1.1 for a discussion of applicable CSA standards). These standards will ensure that manufacturers incorporate standard securement points into their designs.

Table 8.1 Low-floor bus design issues

Location of accessible door
• at the front (on all New Flyer low-floor buses in service);
• at the centre or both front and centre (such as Nova BUS Corporation's low-floor prototype transit bus)
Location of wheelchair positions
• behind the front wheel wells (typical to date); or
• other, e.g., roadside at centre (Nova BUS prototype)
Number of flip-up seats per wheelchair location
• 4 (2 forward and 2 lateral)
• 5 (2 forward and 3 lateral)
Wheelchair securement and passenger restraint
• wheel-rim lock + 2 rear belts, 1 front belt for scooter
• angled stop with 2 rear belts, 1 front belt for scooter (with lap belt if required)
• independent locking system (ILS); wheelchair must be outfitted with "D" rings
• 4-belt systems, 2 front and 2 rear belts, securement for battery operated wheelchairs
• rear-facing compartment system, with head and back rests
• passenger has own belt on wheelchair, or a 3-point belt system (lap and shoulder harness) is provided
Fare payment
• fare box: coins, tokens
• passes and credit systems
• 2-for-1 fare for companions of passengers with disabilities
• electronic: debit card, smart card, proximity card
Stop-request controls
• push button
• touch strip
• bell cord

Persons with sensory or cognitive disabilities, as well as human-factors experts and transport engineers, indicate that more research is required into on-board technology in the following areas:

- validation studies after new technologies have been implemented to ensure that human-factors problems have been considered;
- market research on how technologies designed for persons with disabilities can assist persons without disabilities.

8.9.5 Air Transportation

Boarding procedures under travel conditions such as stress, anxiety, and uncertainty can present a problem to any traveller and, in particular, to a traveller with limited physical and perceptual resources. Additional research is needed to alleviate problems related to walking long distances to gates, wayfinding, waiting in queues, avoiding faster-moving pedestrians, crossing the tarmac under severe weather conditions, handling baggage, and not understanding the public address system.

Many small airports in Canada do not have loading bridges. Passengers must walk across the tarmac to the aircraft and climb a great number of steps. Two TDC studies sought solutions to overcome these obstacles for passengers who have difficulties walking and for persons who use crutches, canes, or walkers (Guthrie, 1993; Rutenberg and Geehan, 1994a). Further development and implementation of these solutions is needed.

Another problem is the number of commuter, regional, and feeder airlines in Canada that use small, inaccessible aircraft. Boarding systems for such aircraft are important for seniors and for persons with disabilities who live in rural areas, for example, and need to get to medical facilities in larger cities.

8.9.6 Urban Rail Systems

The location and configuration of existing urban rail systems presents the greatest challenge to accessibility measures. Given the provisions in the Ontario Human Rights Code that make it mandatory for the conventional system to be accessible, designers probably would not have selected some of the older technology now in use. Considerable research and development is needed to find alternative technology for urban systems.

8.9.7 Intercity Rail Systems

Considerable improvements have been made to the accessibility of intercity rail systems. The areas still requiring attention include multimedia communications systems, tactile cues in terminals and railcars, and a general improvement in customer services (see Section 14.4). A portable train-based lift is also needed for low-volume stations that do not have platform lifts.

8.9.8 Intercity Buses

TDC has sponsored several R&D projects to make intercity buses more accessible to seniors and to persons with disabilities (see Section 15.3.4), but considerable effort is still needed. Such persons experience difficulty with the following:

- narrow aisles and closely spaced seating;
- low platforms in terminals combined with high floors in buses;
- information and communications systems;
- enroute stops at inaccessible facilities;
- lack of on-board lifts, which are needed in rural areas.

Persons with disabilities and seniors increasingly prefer intercity bus transportation for long-distance travel. Its widespread coverage and reasonable prices make it an attractive alternative to train and air travel. While many steps have been taken to make this mode accessible, efforts are rarely coordinated. Future development should address the need for a systematic approach to providing passengers with consistent, effective service throughout the trip, from planning to interfacing equipment to terminal facilities.

8.9.9 Automotive Technology

Continuing effort is needed to ensure that evolving automotive designs can be made accessible for both private vehicles and taxis. For example, the recent discontinuation of the Chevrolet Caprice, a popular model favoured by vehicle adapters, has reduced the options for drivers with disabilities.

Further investigation is needed into:

- securement systems
- safety devices
- adaptive vehicle standards
- heads-up display technology (see Section 8.9.10)
- low-cost audible taxi meters

8.9.10 Intelligent Transportation Systems

Intelligent Transportation Systems (ITS; formerly called Intelligent Vehicle-Highway Systems) are rapidly being developed for all modes, with the major activity occurring in Europe, the U.S., and Japan. The emphasis has been on

personal vehicle driving aids and on traffic management (Guthrie and Phillips, 1995). The potential for integrating automotive, electronics, computer, and communications technologies for the benefit of private vehicle drivers and passengers is discussed in Section 5.2.4. Advanced Traveller Accessibility Systems (ATAS) address the needs of travellers with disabilities.

In the U.S., ITS America has defined research areas. In Canada, TDC has defined a sub-set of the ITS requirements. To 1996, the R&D work in Canada has been fragmented, with no centralized funding program, and the market opportunities have been overlooked (Suen, 1995). Under the European Community's research framework, two consortia, TELAID and EDDIT, are working on several projects involving senior drivers and drivers with special needs.

– 9 –

ACCESSIBLE TAXIS

– 1 – INTRODUCTION

CUSTOMER ACCESS

– 2 – TRIP PLANNING	– 3 – ROADWAYS & TERMINALS	– 4 – PERSONAL VEHICLES

SYSTEM ACCESSIBILITY

– 5 – COMMUNICATIONS SYSTEMS	– 6 – SAFETY & RELIABILITY	– 7 – TRAINING	– 8 – RESEARCH & DEVELOPMENT

PUBLIC CARRIERS: LOCAL

– 9 – ACCESSIBLE TAXIS	– 10 – URBAN BUS SYSTEMS	– 11 – URBAN RAIL SYSTEMS	– 12 – RURAL SYSTEMS

PUBLIC CARRIERS: INTERCITY

– 13 – AIR TRANSPORT SYSTEMS	– 14 – INTERCITY RAIL SYSTEMS	– 15 – INTERCITY BUS SYSTEMS	– 16 – MARINE SYSTEMS

– 17 – MODAL INTEGRATION

Related Information: Use of taxis as feeder systems to urban transit is discussed further in Chapter 10.

9 Accessible Taxis

Disabled people in Canada have used conventional taxis for travelling for a long time. Using full-sized automobiles capable of transporting wheelchairs and baggage in the trunk space, taxi operators have successfully competed with other local modes of transportation.

The taxi market share for 1995 is shown by the following projections from the TransAccess™ Information Base (Goss Gilroy, 1995b):

- Of the 3.8 million persons with disabilities, 630,000 (16.3 percent) use taxis.
- Approximately 24 percent of persons with visual disabilities use taxis.
- Approximately 45 percent of persons 65 years of age or older use taxis.
- Taxis are used most frequently in the province of Quebec where legislation encourages their use as an alternative to paratransit services.
- Approximately 141,000 persons with disabilities use taxis frequently; 252,000, occasionally.

With the introduction of accessible taxis in Vancouver in 1983 and a variety of prototype and converted taxi vehicles in Quebec, Ontario, and Alberta cities since 1989, new taxi markets have developed.

Unfortunately, with a few notable exceptions, the important role of taxis in providing both exclusive and shared rides is not well understood by transportation planners. This is because taxis are part of private enterprise, and do not report directly to any level of government. Because there are no definitive publications on the taxi industry in Canada, it is only possible to give some glimpses, based on experience, of the role of taxis in providing accessible transportation.

The Taxi Coordinator for the Ministry of Transportation of Quebec (MTQ) reports that taxis, which are available everywhere and at all times, on request, constitute a versatile transportation resource able to provide a wide range of services adapted to the many needs of various client groups. In rural areas, they are often the only public carrier available. The centralization of regulatory power in Quebec has fostered the pooling of resources and contributed to a larger role for taxis in the overall system of passenger transportation. The potential for taxi companies to engage in private contracts (unregulated rates) has also contributed to the growth of this market. In particular, it has given rise to shared-ride taxi service in sparsely populated areas and has encouraged the inclusion of accessible taxis in taxi fleets (Trudel, 1992).

This chapter provides an overview of the more important "lessons learned" in the course of reviewing specific experience. These lessons should be of interest to those involved in planning, regulating, and operating this form of service; training drivers; or designing and manufacturing accessible taxis.

9.1 Accessibility Issues

9.1.1 Consumer Perspectives

From a consumer's point of view, the quality of taxi service varies widely from city to city. Restricted entry to the taxi industry at the municipal level often has an adverse effect on service quality, particularly in large cities. Customers typically complain about these issues:

- Taxis are not available when most needed.
- Drivers are inadequately trained and are often unable to communicate with customers.
- Taxi vehicles are not well maintained.
- Taxi vehicles are not accessible to persons who use powered mobility devices.
- Accessible vehicles are being used as goods delivery vans.
- Drivers of low-floor accessible taxis often fail to deploy the ramp and bump the passenger into the vehicle.
- Drivers do not secure wheelchairs and scooters when transporting passengers with disabilities.

Most incidents causing the above complaints can be traced to financial, institutional, and regulatory constraints on the local taxi industry. Many complaints result from the drivers' lack of adequate training.

9.1.2 Financial and Institutional Constraints

The financial and institutional constraints on the use of accessible taxis must be understood by government planning agencies. For example, the taxi industry provides entry-level opportunities for self-employment. Often taxi drivers are new Canadians with limited financial resources.

The major assets of a taxi business are the vehicle and the municipal and provincial licences required to operate as a taxi. Typical costs in 1996 ranged from $10,000 for a used, full-sized automobile to $30,000 for a new deluxe automobile, and from $35,000 to $50,000 for an accessible van. In large cities, where licences are restricted, the value of a municipal licence may be several times the value of the vehicle. This is reflected in the price of transferring the rights to a taxi licence to a new operator (Ottawa-Carleton Regional Municipality, 1989).

Most new entrepreneurs enter the taxi industry in one of two ways: as an owner-operator or as a lessee-operator. Owner-operators own their vehicle and may operate under their own or another person's taxi licence. True owner-operation may exist in

communities where new licences are not restricted. Lessee-operators drive for the vehicle and taxi licence holders on the basis of shared taxi revenues (MANOP, 1995).

Most taxi services are operated through brokers who present themselves to the public as "the taxi company". The brokers advertise the taxi service, provide the necessary communications systems to dispatch vehicles, and may provide financing for vehicles, licensing, and insurance. An individual taxi operator pays a fee to the broker plus the taxi operating costs.

The position of a lessee-operator is analogous to that of a tenant farmer. Having no assets of their own, the lessees must work long hours to pay all the brokerage and operating costs plus a large share of the revenues. Often the taxi owners are not interested in financing the added cost of providing a more accessible service.

9.1.3 Incentive Programs

Under existing financial and institutional constraints, a taxi operator may have no incentive to operate a more costly accessible vehicle. To help alleviate this problem, in February 1988 the Minister of Transportation of Ontario announced an incentive program to encourage use of accessible taxi vehicles. The program provided grants of up to $10,000 per vehicle to taxi operators ordering accessible vehicles. Before the program was cancelled, it funded approximately 150 accessible taxi vehicles in Ontario municipalities.

Similar programs have been introduced in other provinces.

9.2 Regulation

With the exception of the province of Quebec, taxi services are normally regulated solely by municipal governments. In Quebec, in addition to any municipal regulations, the MTQ centrally regulates taxi operations under the Act regulating Transportation by Taxi, 1993. The MTQ has developed training and retraining programs for taxi drivers that are becoming compulsory in some municipalities (Trudel, 1993).

The federal Motor Vehicle Safety Act, in effect since January 1971, establishes mandatory standards to ensure that new motor vehicles manufactured in or imported into Canada meet minimum vehicle safety and environment protection criteria. The Road Safety and Motor Vehicle Regulation Directorate of Transport Canada administers the Motor Vehicle Safety Act and the Motor Vehicle Tire Safety Act and enforces regulations pertaining to these acts.

9.2.1 Vehicle Certification

Original equipment manufacturers (OEMs) are responsible for ensuring that their products are safe. This responsibility includes a requirement to recall a vehicle for up to five years to correct any defective components that affect safety. An OEM can be responsible for a modified vehicle if modifications to the stock vehicle are carried out in accordance with its instructions and concurrence. When significant modifications are made to the stock vehicle, the secondary equipment manufacturer (SEM) must certify that the modified vehicle meets the required safety standards and must be responsible for any recalls due to the modifications. To date, SEMs have generally taken the stance of "self-certification", declaring that their products comply with the law. However, if required by the federal Motor Vehicle Safety Inspectors to demonstrate compliance, documentation must be submitted for examination and approval. Crash-testing, often required for certification, represents a substantial added cost for accessible vehicles over regular taxis, which are mass-produced stock models already tested by the OEM. For the numerous small SEMs, certification represents a financial challenge and affects the final market price of the vehicle.

9.2.2 Warranties

OEMs are responsible for their warranties on stock vehicles. They provide parts inventories and warranty service through their network of dealers. When SEMs become involved, it is not always clear who is responsible for stocking spare parts and for warranty service. The ideal situation would be for the OEM dealer network to stock the additional parts and provide service. The cost of warranty service could be built into the price of the vehicle. However, this is only practical if SEMs use standardized components that are readily available in the automotive trade. At present, there are numerous small SEMs using a variety of automotive parts.

9.2.3 Standards

In 1984, the Canadian Standards Association (CSA) published the first edition of CSA-D409, a National Standard of Canada for *Motor Vehicles for the Transportation of Persons with Physical Disabilities*. This voluntary standard was developed in response to a need for standards for the manufacture of small paratransit buses and vans of less than 10,000 kg. At that time, standards for vans used as accessible

taxi vehicles were not a significant issue. (In 1984, Vancouver was the only city in Canada with accessible taxis.)

Since 1984, D409 has been revised several times. It is currently available as CAN/CSA-D409-92. Further revisions are continuing. To date, only Ontario has adopted D409 in its entirety. Some aspects of D409, such as a requirement for passengers using wheelchairs to face forward or rearward, have been adopted by other provinces. (For further discussion of CSA standards see Section 6.1.1.)

9.3 Development of Vehicles and Markets

Taxi companies using full-sized automobiles historically have been able to transport significant numbers of customers with disabilities, including seniors, ambulatory persons with disabilities, and persons who could transfer from a wheelchair to a conventional automobile seat (and whose wheelchair could be carried in the trunk of the taxi).

As automobiles became smaller, accommodating such customers became more difficult. Persons dependent on electric wheelchairs or scooters cannot be transported in a regular taxi. Passengers with manual wheelchairs must go through the sometimes risky process of transferring in and out of the vehicle, since the chair must be stored; and, by assisting, the driver risks work-related injuries. The additional boarding and deboarding times also have financial implications. Clearly, there is a need for more accessible vehicles.

9.3.1 Purpose-Built Vehicles

During the late 1970s, the Transportation Development Centre (TDC) sponsored a series of studies of vehicles appropriate for transporting persons with disabilities. One result of this research was the development of prototype taxis by GSM Taxi Ltd. of Montreal. Financial support for the development of the GSM taxi was provided by the federal and Quebec governments. The proposed taxi had a capacity of five passengers, three on a bench seat and two on folding seats that could be raised to provide space for a wheelchair user. Three prototype vehicles were produced for display at EXPO '86 in Vancouver (Atkinson, 1985).

In 1990, TDC undertook a design and development project with GSM Taxi Ltd. to produce a new purpose-built prototype vehicle that was purchased by the city of Montreal and put into demonstration service (see Figure 9.1).

Figure 9.1 **Purpose-built accessible taxi prototype**
(GSM Taxi Ltd.)

9.3.2 Modified Vehicles

In 1982, Vancouver Taxi Ltd. was granted 30 additional taxi licences by the city of Vancouver, conditional on obtaining accessible taxis. The company intended to use the GSM taxi, but learned that the vehicles could not be supplied on schedule. A search was undertaken for an alternative taxi vehicle.

A local urban and intercity bus rebuilder, Levett Auto Metal Ltd., was requested to assist in the location of 30 Checker Cabs for rebuilding as dual taxicabs. Levett received the first three Checker Cabs in December 1982, and a prototype was produced.

The prototype taxi was presented to the Vancouver Board of Vehicles for Hire in April 1983. Levett subsequently received approvals for the Checker Cab prototype from the Board, the BC Motor Carrier Commission, the BC Ministry of Transportation and Highways, and the Motor Vehicle Safety Branch of Transport Canada. The production of an additional 29 accessible taxis was completed by March 1984. One of these was still in service 10 years later (see Figure 9.2).

Figure 9.2 Accessible taxis for Vancouver
(Levett Auto Metal Ltd.)

By 1985, some of the Checker Cabs were showing their age, and a search began for a suitable replacement vehicle. Over an 18-month period, Levett developed a new design based on the Chrysler minivan chassis, which was selected after an evaluation of all available options. Levett's side-facing design accommodated one person in a wheelchair plus four ambulatory persons. An optional layout providing for two persons in wheelchairs plus three ambulatory persons was also offered (see Figure 9.2).

The design, approved by Transport Canada (Motor Vehicle Safety Standards) in March 1988, was similar to other vehicles being developed in Great Britain and the United States. Approximately 60 vehicles were built by Levett, and most of them were still in service in 1996.

Unfortunately, the Levett design was produced just prior to the introduction of CSA Standard D409. Because British Columbia adopted the forward- or rear-facing wheelchair position requirements of CSA D409, Levett ceased production.

Since 1988, a variety of accessible taxi designs have been developed in Canada and the United States. The quality of converted vehicles has improved considerably. Canadian distributors are importing several models, some of which were used in demonstration projects. Examples of these taxis can be seen in Figure 9.3.

9.3.3 Accessible Taxi Demonstrations

Several accessible taxi demonstrations have been held in Canada, including those in Alberta, Ontario, and Quebec. The results of these projects are presented in the following sections.

Exclusive-Ride Demonstration in Ottawa

In 1989, the Ministry of Transportation of Ontario and TDC jointly funded a demonstration of four accessible taxis operating as part of the regularly dispatched taxi fleet in Ottawa. The results of the demonstration suggest that a fleet of 50 accessible vehicles (about 5 percent of the dispatched fleet) would be required to satisfy the market for exclusive rides in Ottawa (Robinson, 1992).

Shared-Ride Demonstration in Quebec

In the Quebec taxi demonstration, where accessible taxis were used to complement paratransit service, passengers with disabilities preferred the door-to-door personal transportation and the anonymity of the accessible taxi vehicles over minibuses. The lack of advance reservation and the faster response time were cited as added advantages. Each of the four types of vehicle tested had its strengths and weaknesses and there was much room for improvement.

The latent market for accessible transportation in Quebec has been estimated at 10.8 percent of a population of 6,500,000. Capturing even a portion of it would represent a significant new market for the taxi industry (Godbout, 1995).

Evolving Brokerage System in Edmonton

DATS (Disabled Adult Transportation System) – an accessible taxi system – has been operating in the city of Edmonton since April 1975. With financial support from TDC in 1985, a new delivery organization was established to evaluate the brokerage concept for coordinating trip assignments most effectively.

By 1990, with more than 100 individual contracts, DATS had become one of the largest employers of taxis in Canada. This substantial new business opportunity for taxi operators allowed several contractors to purchase accessible vehicles. In 1994, accessible taxis for exclusive-ride service were also tested in Edmonton and in two smaller communities in Alberta (C.J. Smith & Associates, 1995).

Lessons Learned

The following are some of the important lessons learned from the demonstration projects in Quebec, Ontario, and Alberta (Smith, 1992a; Alberta, 1995a):

- Purpose-built vehicles were found to be more durable, but also more costly than converted minivans.
- Lowered-floor designs were preferred over raised-roof designs.
- The success of the service largely depended on the attitudes of management and staff and the amount of training and support provided to taxi drivers.
- In Ottawa, passengers using wheelchairs represented a surprisingly large percentage of all customers – approximately 12 percent.
- Incentives are needed to offset the additional capital and operating costs of deploying accessible taxi vehicles.

9.3.4 Market for Accessible Taxis

The ratio of authorized taxi licences to Canada's urban population is about one licence per 800 persons. The actual number of taxis in service may be less than this, depending upon economic conditions. Based on the above ratio, the national inventory of taxis is estimated to be about 30,000. It is also estimated that less than one percent of this inventory was fully accessible to persons who used wheelchairs in 1995 (MANOP, 1995).

The largest concentration of accessible taxis at present is in the Vancouver area, where about 6 percent of taxis are accessible. Based on Vancouver's experience and several demonstration projects in Alberta, Ontario, and Quebec, it is estimated that in most cities 5 percent of taxis would need to be accessible to meet the needs for independent travel in the short term. Higher percentages would be needed in retirement communities.

Making 5 percent of the national taxi inventory accessible would require approximately 1,500 vehicles. Based on a three-year replacement cycle, 500 new vehicles would be required annually. Allowing for some purchases by paratransit operators for shared-ride services, the annual market in Canada could be supplied by one or two SEM assembly lines.

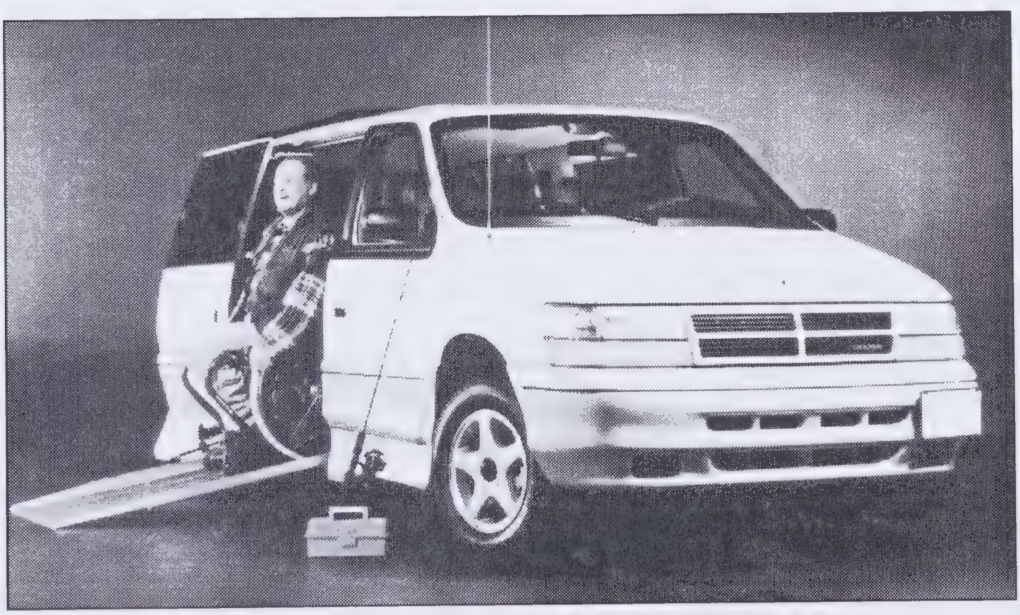


Figure 9.3 **Currently available accessible taxis**

Top: Freedom Motors Chrysler minivan KNEELKAR conversion

Bottom: Ricon Canada Inc. low-floor Chrysler minivan conversion kit

9.4 Taxi/Transit Services

9.4.1 Shared-Ride Service Contracts

The relatively high cost of paratransit services for customers with disabilities has encouraged communities to look for alternatives. Some of the techniques used are:

- making the conventional transit services as accessible as possible for ambulatory persons with disabilities;
- limiting the use of lift-equipped paratransit vehicles to persons with severe physical disabilities;
- using taxi services for seniors and ambulatory persons with disabilities who are unable to board conventional transit but do not require a lift-equipped vehicle;
- brokering services among several public carriers, taxi operators, and volunteer services to ensure that the appropriate service is provided to the user at the lowest cost.

The use of taxis to supplement transit services has become fairly universal in Canada. Table 9.1 presents a summary of taxi industry characteristics from the perspective of transit agencies that have contracted for shared-ride service (DS-LEA and MANOP, 1988).

9.4.2 User-Side Subsidies

User-side taxi subsidies are quite common in small urban and rural communities where delivery systems for transit or paratransit services may not exist. In large cities, the technique may be used to supplement transit services. In some cases, the local taxi company may provide discounts for seniors and flat rates for persons with special needs.

One of the least complicated methods of delivering taxi service to persons with disabilities is illustrated by the taxi charge program in effect in Calgary, which supplements the Handi-Bus service. This taxi charge program gives ambulatory persons with disabilities 24-hour access to transportation.

Persons wishing to qualify for the Calgary program must have a limited income and must have a physician verify that they are unable to use the Calgary Transit System safely because of a mental or physical disability. The program was initiated in 1974 and substantially expanded in 1983. With the introduction of accessible taxis in 1990, the service became available to a wide range of clientele.

The Calgary Social Services Department administers the program. A monthly subsidy limit is established, based on the trips needed for reasons of work, education, medical appointment, or personal business. Each rider is issued a plastic card similar to a credit card. Embossed on the card is the user's name, registration

number, and the subsidy limit. When transportation is required, the rider calls the preferred taxi company from among the ten companies participating in the program. The companies invoice the city monthly for the service.

A similar program using accessible taxis was introduced by BC Transit in the Vancouver region in 1991. It has been very successful and has been copied in Victoria and in several other B.C. communities.

Table 9.1 Characteristics of the taxi industry in Canada (based on service contract experience)

Capital Investment	Relatively small, facilitating the expansion of existing services and/or introduction of new carriers.
Management	Hands-on management; often directly in charge of operations with no more than two levels between the drivers and senior management.
Overhead Costs	Relatively low, compared to other public carriers.
Communications	On-line and very effective.
Dispatching	Effective; little conversation; large systems usually automated.
Reliability	Generally good, except during unusual weather conditions.
Convenience	Generally good for seniors and ambulatory persons with disabilities (folding wheelchairs can be stowed in most taxis).
Consistency of Service Provided to Customers with Disabilities	May be difficult to control, particularly in large taxi fleets, due to random trip assignments; requires dedicated service component and responsible management.
Driver Turnover	High among younger drivers.
Training	Often non-existent unless provided by a public agency.
Driver's Compliance with Contract	Difficult to ensure since drivers are often "third parties" to the contract; may require individuals to co-sign the contract.
Vehicles	Improvements in design are generally needed; accessibility and comfort can vary considerably.
Availability and Interest of Contractors	Varies considerably depending on restrictions on the numbers of taxis, demand during peak periods, and amount of competition for trips.

9.5 Guidelines for Planners and Designers

The following conclusions, which apply to Canadian conditions, were drawn from a recent European seminar on transportation for persons with mobility disabilities (European Conference of Ministers of Transport, 1992):

- Taxis are an essential link in the accessible transportation chain.
- People with mobility disabilities represent a significant new market for taxi operators.
- There is a universal need for an accessible mainstream taxi designed for the purpose.
- Central governments should take the lead in developing the design parameters for an accessible taxi vehicle.
- Cooperative partnerships between all levels of government, consumer organizations, and taxi organizations are needed to deliver the right mix of services at the local level.
- A combination of subsidies and incentives will likely be required to ensure that taxi operators purchase and operate accessible vehicles.

Table 9.2 presents a summary of the design requirements for accessible taxis.

For the more detailed planning and design information needed in the development of accessible taxis and taxi services, consult the following resources:

- Section 6.1 for safety regulation;
- Section 7.5 for taxi driver-training programs;
- Sections 10.3 and 12.4 for the deployment of taxis in transit and paratransit services;
- Canadian Standards Association CAN/CSA-D409-92 on Motor Vehicles for the Transportation of Persons with Physical Disabilities, Z604-95 on Transportable Mobility Aids, and Z605-95 on Mobility Aid Securement and Occupant Restraint Systems;
- The three provincial government agencies in Canada that have the most experience with accessible taxis: the ministries of transportation of Quebec and Ontario, and the Alberta Transportation and Utilities Commission.

Sound ergonomic design is a prerequisite for accessibility. Specific design criteria have been established for the ideal accessible taxi vehicle based on the Ontario and Quebec experiences. It has been suggested that design features should respond to the needs of all groups, including persons with mobility, sensory, cognitive, and developmental disabilities. This represents a major challenge for vehicle modifiers and manufacturers.

A vehicle that meets all these requirements has been developed in Great Britain – the typical London black cab. To make it accessible, the two passenger doors have been changed to swing open more than 90 degrees. Two rearward-facing fold-up seats are attached to the bulkhead. The one located near the left door pivots to the outside to accommodate passengers with mobility aids. A manual telescoping ramp (consisting of two sections for regular wheelchairs, three for scooters with a centre wheel) is stored near the driver's seat.

The driver deploys the ramp sections manually, pushes the wheelchair passenger up the ramp and faces the wheelchair towards the rear of the vehicle. Passengers who cannot face the rear are positioned to face sideways. A rear bench made in two sections can accommodate seated persons or be flipped up to accommodate larger wheelchairs. The passenger compartment can accommodate five passengers, including one wheelchair (one wheelchair and one passenger facing rear, and three passengers on the rear bench facing front).

In this purpose-built cab, the driver and passengers are separated by a glass partition, allowing communication but preventing driver distraction. The glass partition between the driver and the passengers also protects against attacks. (In a recent survey in London, England, 31 out of 561 attacks on taxi drivers were on drivers of purpose-built cabs). Doors are electronically locked while the vehicle is moving. Safety belts are fitted for passengers in wheelchairs (Rutenberg, 1995b).

Table 9.3 presents a summary of some incentives to acquire accessible taxis.

Table 9.2 Design requirements for accessible taxis

Customer's requirements • a low-floor vehicle (25 cm above road surface) • an adequate running board • adequate interior height (average 130 cm) • well-protected remote door-opening mechanisms • dangerous parts to be covered or recessed • good wheelchair securement and passenger-restraint system • adequate head clearance for all seats • comfortable seat design • excellent outside visibility from all positions • adequate storage spaces for mobility aids • adequate lighting, especially on the floor • stable heating and air-circulation systems • sufficient handrails, grips • non-slip flooring • adequate driver-passenger communications, particularly for passengers with sensory limitations • brightly coloured step edges
Driver's requirements • four doors for ease of access to front and rear seats • hinged doors with a mechanism to ensure they remain opened if desired • a ramp integrated into the vehicle design, so that it requires limited handling by the driver and does not interfere with ambulatory customers' movements • room for up to two wheelchairs and a seated passenger or up to four seated passengers • passenger restraints and wheelchair securements that are easy to use • a waterproof floor covering to facilitate maintenance
Owner/operator's requirements • a purpose-built or remanufactured vehicle with minimal modifications to the stock vehicle • reliable mechanical performance (e.g., brakes, transmission, and suspension) • reasonable capital and operating costs
Regulator's requirements • OEMs must obtain motor vehicle safety standards (MVSS) certification and warrant the basic vehicle • OEMs must be responsible for recalls in case of defects • SEMs must obtain OEM approval for modifications • SEMs must work with OEM dealerships to ensure availability of parts and service • SEMs must obtain MVSS certification where applicable

Table 9.3 Incentives to acquire accessible taxis

Jurisdiction	Regulation	Incentives
Municipal	Taxi bylaws should be amended to provide for shared-ride operation and new licences issued on the basis of contracts for accessible services. Community resources should be coordinated to promote and optimize taxi use.	Small communities and rural areas should contract for services to seniors and persons with disabilities. Medium-sized cities should supplement existing van and bus services. Large cities should use scrip (voucher) systems controlled by the city.
Provincial	Additional licences should be based on contracts in hand – including commodity deliveries – not on urban populations.	Grants should cover retrofit costs, not just purchases of new vehicles. Provincial contracts for taxi services should be conditional on accessibility.
Federal	Work should continue on revisions to CAN/CSA D409 to accommodate taxis as unique vehicles. Further research is needed on a low-cost accessible taxi design suitable for mass production or importation.	Federal incentives for manufacture of low-cost accessible vehicles should continue.

(TRANS-OP Consulting Services, 1995)

– 10 –

URBAN BUS SYSTEMS

– 1 – INTRODUCTION

CUSTOMER ACCESS

– 2 – TRIP PLANNING	– 3 – ROADWAYS & TERMINALS	– 4 – PERSONAL VEHICLES

SYSTEM ACCESSIBILITY

– 5 – COMMUNICATIONS SYSTEMS	– 6 – SAFETY & RELIABILITY	– 7 – TRAINING	– 8 – RESEARCH & DEVELOPMENT

PUBLIC CARRIERS: LOCAL

– 9 – ACCESSIBLE TAXIS	**– 10 – URBAN BUS SYSTEMS**	– 11 – URBAN RAIL SYSTEMS	– 12 – RURAL SYSTEMS

PUBLIC CARRIERS: INTERCITY

– 13 – AIR TRANSPORT SYSTEMS	– 14 – INTERCITY RAIL SYSTEMS	– 15 – INTERCITY BUS SYSTEMS	– 16 – MARINE SYSTEMS

– 17 – MODAL INTEGRATION

Related Information: Interurban bus systems are discussed in Chapter 15.

10 Urban Bus Systems

Canadian transit systems are an integral part of the social fabric of the communities they serve. The quantity and quality of transit services provided and the related service policies are part of the local social contract. It is important to understand that each province and municipality has developed its own accessibility strategies.

Transit policy planners are currently facing some very serious challenges. On the one hand, the technology of transit accessibility is improving rapidly; on the other, transit systems are under severe financial constraints. In the very near future, several choices in the design and deployment of new vehicle technology must be made. Otherwise, if all customers are to be given access to them, transit systems could be faced with costly retrofitting in the years to come.

At present, the Canadian transit industry is involved in a comprehensive review of options and trade-offs. Some of these options impose constraints on the historic way in which service has been delivered to seniors and persons with disabilities. Rapid developments in low-floor bus technology in Europe, including provisions that make it possible to transport passengers using mobility devices in comfort and safety, are influencing Canadian analyses. The thrust in Europe is to provide bus designs that offer significant improvements to all passengers, while meeting the special needs of older passengers and those with disabilities (Prentice, 1992). This chapter presents the current issues and trends, and provides some technical guidelines.

Projections of the 1991 Health and Activity Limitation Survey (HALS) data to the year 1995 provide the following statistics on rail and bus transit usage by Canadians with disabilities (Goss Gilroy, 1995b).

- It is estimated that of the 3.8 million adults with disabilities, 1.2 million (31.4 percent) use conventional rail and bus transit systems, and 112,000 (2.9 percent) use paratransit systems.
- In 1995, an estimated 55 percent of persons with severe disabilities used paratransit systems, compared to 19.2 percent of persons with severe disabilities who used conventional transit systems.

The TransAccess™ Information Base, from which the above statistics were derived, includes data on the difficulties encountered by persons with disabilities when using conventional transit systems. Since the data were gathered in 1991, just prior to major improvements in transit accessibility, projections to the year 1995 may no longer be accurate. In addition, a significant number of customers are shifting from paratransit systems to accessible fixed-route systems. This shift may affect several factors, including the relative usage of both types of transit service.

The TransAccess™ Information Base provides some useful clues as to why people with disabilities do not use transit services:

- Although approximately 85 percent of the urban population of Canada and of most rural areas have some form of accessible transit service, many persons with disabilities are not aware of these services.
- Persons with speech disabilities are more likely to encounter difficulties using conventional transit services than are those with other types of disabilities.
- The difficulties cited by persons with disabilities when using conventional transit services included:
  - getting on and/or off the vehicle;
  - standing in the vehicle while it is moving/accelerating/braking;
  - getting to and/or locating the bus stop;
  - waiting at the bus stop;
  - finding space to sit on board.

10.1 Accessibility Issues

10.1.1 Access Versus Mobility Issues

Prior to the availability of low-floor buses, most Canadian transit agencies delivered accessible transit services through specialized parallel (paratransit) systems. Small buses, vans, and taxis were operated in parallel to the fixed-route bus and rail systems. Urban and rural communities without fixed-route transit services used similar techniques to accommodate a variety of special needs. By 1992, more than 400 such systems operated in the urban and rural areas of Canada (Canadian Urban Transit Association, 1993). In some major cities, where the rail systems and terminals are accessible, it is possible to transfer passengers to and from the parallel systems. (See Chapter 11 for a discussion of accessible urban rail systems.) These parallel services provide a very high level of door-to-door mobility, but they are more costly to operate per passenger served than fixed-route services (see Table 10.1).

The Limitations of Parallel Systems

Paratransit systems did not fully satisfy the mobility needs of the communities they served. From an operating agency perspective, the high quality of service induced considerable demand, which strained financial and human resources. From a customer perspective, it was rarely possible to make spontaneous trips. In addition, most paratransit services limited access through a variety of screening processes, including eligibility categories, registration procedures, trip-purpose priorities, and time-of-day priorities.

Table 10.1 Comparative costs per passenger trip for accessible transit (1994 dollars)

	Small Cities ($)	Mid-Sized Cities ($)	Large Cities ($)
Fixed-route transit	1.20 – 1.80	1.60 – 2.20	1.60 – 3.20
Community bus on flexible routes	3.00 – 5.00	5.00 – 10.00	7.00 – 12.00
Door-to-door bus and van systems	8.00 – 12.00	10.00 – 15.00	15.00 – 40.00
Shared-ride taxi systems	4.00 – 6.00	6.00 – 10.00	10.00 – 15.00

(MANOP Services Ltd.)

Brokerage Systems

During the 1980s, transit agencies developed a number of techniques to control costs and accommodate increasing travel demands. These techniques included the transfer of the more ambulatory customers to auxiliary services, often contracted out to taxi companies, and the use of electronic technology to manage trip requests and trip assignments to specific drivers and/or vehicles. Such techniques allowed transit agencies to stretch their systems to accommodate increasing demand, but they did not fully satisfy the demand for local travel (Grimble, 1987; Geehan, 1987; Atkinson, 1992).

Accommodating Ambulatory Persons

It was recognized that seniors and ambulatory persons with disabilities represented a growing market for accessible transit. This led to the introduction of the Improved Accessibility to Conventional Transit Service (IACTS) program in Ontario and, when the first small, low-floor buses became available, a deployment technique known as Community Bus (see Section 10.3.3).

The IACTS program is intended to make conventional transit buses as accessible as possible to seniors and the more ambulatory persons with disabilities (Delcan, 1994). The accessible Community Bus technique links residences and activity centres frequented by seniors. In the larger cities, this technique may be used to provide convenient service in local neighbourhoods. In small cities, it is often used to accommodate direct travel between seniors residences, shopping centres, hospitals, social and recreational facilities, and medical clinics (Ontario, 1993).

New Technology

In 1989, BC Transit (a provincial Crown corporation) adopted a policy of full transit accessibility, a policy typically used in transit systems in the United States. This program was barely under way when New Flyer Industries Ltd. of Winnipeg, Manitoba, developed the first full-sized, Canadian, low-floor transit bus. The low-floor technology has had a substantial effect on the way in which Canadian transit systems deliver accessible services (see Section 10.4.2).

10.1.2 Eligibility and Reciprocity Issues

The continuing deployment of low-floor buses on fixed bus routes and semi-fixed routes, such as Community Bus, is likely to focus the issue of eligibility for paratransit service. Since paratransit service is more expensive to provide on a per passenger basis, transit agencies will try to transfer as many customers as possible to the fixed-route services. Customers who remain with paratransit service are likely to have severe or multiple disabilities. In addition, the eligibility of attendants must be considered for all services. Seasonal conditions will affect the preferences for service options, with paratransit service being preferred when pedestrian access to bus stops becomes difficult or dangerous.

The transit agencies that are successful in reducing demand on paratransit service to those most in need are likely to employ the following strategies:

- improve pedestrian access and crosswalk safety (see Section 3.3);
- provide high-quality trip-planning information and assistance (see Section 2.4);
- train the drivers on the fixed-route services to be more aware of special needs among their customers (see Section 7.3);
- employ a brokerage type of matching of trip demand to the most appropriate carrier;
- employ an impartial agency for eligibility screening and/or appeal adjudication;
- provide customer-service representatives to discuss customer needs and to encourage customers to use alternative forms of accessible transit;
- provide substantial marketing when alternative services are introduced.

Informal reciprocal arrangements exist between most agencies providing paratransit services. For example, if people eligible for Wheel-Trans service in Toronto visit a prairie city, they would likely be accepted on the Handi-Bus service. Some systems, such as DATS in Edmonton, provide temporary registrations for visitors.

Ironically, problems with reciprocity are more likely to occur in large metropolitan areas, where carriers have clearly defined boundaries. Before 1986, handyDART service in the Vancouver region was generally available only to residents of British Columbia. During EXPO 86, this policy was broadened so that

handyDART could be used by any eligible person, whether resident or visitor. The cost of this small amount of additional service increased the annual handyDART budget by less than one percent. BC Transit subsequently adopted this "open door" policy throughout the province. This is certainly an area in which a standardized service policy can be beneficial.

10.1.3 Customer-Specific Needs

Accessibility to and within an urban bus is determined by the following:

- access to the bus stop (discussed in Sections 3.3.3 and 3.3.4)
- information and communication
- boarding
- fare payment
- proceeding to a seat or to a wheelchair space
- manoeuvring into position
- preparation for securement
- deployment of securement and passenger restraint
- making a stop request
- emergency procedures (discussed in Section 6.4)
- deboarding
- transferring to other modes (discussed in Section 17.2)

An ergonomic study identified troublesome tasks that must be performed by urban bus customers (Arnold, 1993).

Identifying the Bus Correctly

Tasks that can be difficult for passengers who are blind, visually impaired, or learning disabled include identifying the appropriate boarding location and the correct bus to board. When a bus stop is used by more than one bus route, and buses arrive at the same time, passengers who are blind may have problems selecting the correct bus. Some customers with learning disabilities have difficulty associating bus numbers with different routes. Others find it difficult to process visual information about bus route numbers because this information gets confused with licence plate numbers, bus identification numbers, and fares.

Destination signs are often too small, have poor contrast, or are covered by glass, which reflects light, making the signs difficult to read. Newer electronic signs are easier for customers who are visually impaired to read, provided there is no glare on the sign (Atkinson and Geehan, 1994).

Difficulties can arise for customers with learning disabilities when the bus route number is displayed directly beside the destination street number. When

numbers are used for both pieces of information, these customers can become confused.

An "express" bus is typically only identified with a printed sign, rather than with a pictogram or an auditory message. This can create confusion for people who, because they are unable to read or see the sign, expect to be able to get off the bus at non-express stops along the route.

"Bus hailing kits" have been used with some success by customers with disabilities. The kit consists of a series of bus numbers which can be used to identify the route the passenger requires or to show a driver that the customer would like the bus to stop.

Boarding the Bus

Passengers using mobility aids, such as canes, crutches, or walkers, experience varying degrees of difficulty in negotiating the steps into a bus. Such passengers and seniors may have strength, stamina, and balance problems. They are best served by low-floor buses, providing there are adequate grab rails in the bus entranceways.

Passengers who use wheelchairs and scooters can only be accommodated in low-floor and lift-equipped vehicles.

The location of the first step on urban buses is difficult to identify for some customers who are blind or visually impaired. Buses with high-contrast markings on the front edges of their steps make this task easier for persons with visual impairments.

Some bus drivers become impatient with questions from people whose disabilities are not visible, such as a hearing impairment or a learning disability. People with learning disabilities, for example, are sometimes told to "just read the sign" when they ask drivers about destinations. This is both frustrating and embarrassing for customers, and they are left without their most important source of information – the driver.

Moving Within the Bus

Passengers who use mobility aids may experience problems if the floor of the bus is not flat or if there are not enough grab rails. Such passengers select seats towards the front to avoid traversing the bus, particularly if it is in motion. Passengers in wheelchairs may have difficulty reaching fare boxes. Backing on and/or turning around may be difficult for some passengers who use wheelchairs or scooters, especially when other passengers are seated at the front of the bus.

Customers who are blind or visually impaired may have difficulty moving within the bus. Visually impaired passengers rely on visual cues from such things as handholds and chair backs, but these are usually not marked with contrasting colours.

Paying the Fare

Customers with visual or learning disabilities can have difficulty paying the fare. For most bus systems, information about fares is provided on a visual sign, at the bus stop, on the outside of the bus, or inside the bus, often in very small letters that are difficult for people with poor vision to see. Customers with poor vision prefer to be self-sufficient by reading information that is presented in large print.

Learning disabled customers may have problems determining fares from visual signs, and may find the fare zones and peak and off-peak fare systems confusing. Some customers are too nervous to ask the driver for help. Participants at a recent focus group said their strategy for dealing with the confusing issue of bus fares was to pay the highest fare, thereby ensuring that they have paid enough.

Sitting

Courtesy seats are located at the front of most buses and are designated for passengers with special needs. Some difficulties arise for customers who are blind or visually impaired as they may not be able to identify the courtesy seats on their own. Courtesy-seat signs are often very small, with no tactile information. Furthermore, pictograms used to designate courtesy seats may not be consistent between different buses, and this can create confusion for customers who are visually impaired or learning disabled.

Typically, the colouring of the courtesy seats is the same as that of the other bus seats, making it difficult to distinguish them from the others.

Passengers with guide dogs often prefer to sit in the first forward-facing seats, which may fold up for wheelchairs. On some buses, blind passengers find the space underneath the courtesy seats inadequate for their dogs to lie down. Dogs then have to remain in the aisles, where they can get in the way of other passengers.

Customers who use wheelchairs for mobility must cope with the wheelchair-securement and passenger-restraint systems on buses. Customers with good upper-body strength who use manual chairs experience few manoeuvring problems, and can assist with their securement. Others, who use conventional electrically powered chairs, will likely need assistance with securement and restraint systems.

Information About On-Board Regulations

Visual signs create difficulties for customers who are blind or visually impaired. None of this information is provided in either an auditory or a tactile form. Signs are often obscured by the advertising displayed in buses.

Some of the signs about on-board regulations, such as those indicating “no eating” and “no smoking”, are placed at the very front of the bus. This makes it awkward for passengers sitting near the back of the bus to see the signs. Passengers who are visually impaired may have difficulty even from the front seats.

Making a Stop Request

This task is often difficult for customers with sensory or cognitive disabilities. Difficulties include determining the location of the bus relative to the desired stop, determining the type and identifying the location of the mechanism for making a stop request, and identifying the desired stop.

Passengers who are blind or visually impaired have no systematic means of knowing where they are on a bus route at a particular time. Most of these passengers ask the driver to tell them when they are approaching their stops. Drivers often forget these special requests, or they may change shifts part-way through the route and forget to tell the new drivers about the requests. During busy times when the buses are overcrowded, it may be difficult to hear the drivers and impossible to communicate with them. To assist passengers in communicating this information to drivers, BC Transit developed a "reminder card". Passengers with disabilities are supplied with reminder cards, which they give to drivers as a reminder of their request.

Passengers with visual impairments may have difficulty identifying the stop-request mechanism. On many buses, a cord is used for this purpose, and it is not easy to see. Some buses also have stop buttons on the stanchions in front of the courtesy seats but they are not always clearly labelled as stop-request buttons. During a simulation, one participant who was learning disabled thought the buttons were for emergency use because they were red, and there was no indication what they were meant for. Passengers who are either deaf or hearing impaired have difficulties on crowded buses or when the windows are covered with fog because they cannot see the visual landmarks they rely on to identify their stops.

Customers with learning disabilities may also find making a stop request difficult. Without regular announcements, they are often confused about where the bus is in relation to their destination. Some passengers are not confident that the bus driver will tell them the correct stop if they ask for assistance. Some on-board route maps are difficult for learning-disabled customers to understand.

Deboarding

Even though passengers are supposed to exit via the rear doors, many with disabilities prefer to exit via the front doors because of their proximity to the courtesy seats. Many buses have hand railings at the front which help to guide passengers on and off the bus.

Some passengers who are blind, visually impaired, or learning disabled have difficulties determining how to use the vehicle exit mechanism. Door-opening mechanisms vary on different buses. Sometimes the doors open automatically after the driver has activated the door and the passenger steps down; sometimes barriers must be opened; and sometimes the door has to be pushed. These alternative mechanisms create confusion for most bus passengers.

Often exit door signs are inadequate: the print may be too small, and there is nothing tactile to assist persons with visual disabilities.

Carrying Out Emergency Procedures

Dealing with emergencies, particularly evacuating after a collision or a fire, can be difficult for all passengers. Typically, city buses have two types of emergency exits: emergency window exits and emergency roof exits. The window exits are fairly easy to find and open, but the roof exits are difficult to find and almost impossible to open (see Chapter 6).

10.2 Regulation

In Canada, responsibility for transit service is vested in the provincial and territorial governments; each province exercises this mandate somewhat differently. With the exceptions of British Columbia and the GO Transit service in Ontario, this responsibility is delegated by legislation to municipalities.

10.2.1 Institutional Arrangements

Within the provinces and territories, six types of institutional arrangements are used for the delivery of urban transit service:

- service contract;
- municipal government department;
- department of a public utilities commission;
- transit commission;
- municipal corporation;
- services operated directly by a provincial government, through a provincial Crown corporation (e.g., BC Transit) or operating authority.

The success of public transit in any city has more to do with the abilities of the people involved and the political will to make difficult decisions than with the particular organizational arrangements (CUTA, 1993).

A substantial number of conventional transit services and most of the paratransit services in the smaller Canadian communities are contracted out. For example, in Ontario in 1988, some 25 conventional systems out of 59 were contracted out (Transmode, 1989). In British Columbia, all conventional transit systems, except for those in Vancouver and Victoria, and all the paratransit systems, are contracted out to municipalities, private contractors, or non-profit agencies. In the case of systems operating 10 or more vehicles, the municipality usually

employs a coordinator to manage the contract. The contractor must provide the direct supervision.

In the prairie provinces, transit service is usually delivered through a municipal government department, while the provinces of Ontario and Quebec have assigned the responsibility for transit in most large urban areas to transit commissions. Smaller communities in Ontario often deliver transit services through a public utilities commission, as in Brantford, Stratford, and Kingston. Other types of transit delivery organizations can be found in Quebec (e.g., Corporation métropolitaine de transport de Sherbrooke) and the Atlantic provinces (e.g., Halifax Transit Corporation).

British Columbia has placed the responsibility for all urban transit service in the hands of a provincial Crown corporation, BC Transit. The corporation reports directly to a member of the provincial cabinet and is administered by a board made up of local politicians and members-at-large. The metropolitan areas of Vancouver and Victoria have transit commissions made up of local mayors and politicians. In smaller communities, municipal councils or regional district boards replace these commissions as the primary local decision-making body. Technical advice is provided by BC Transit, by municipal staff, and by local representatives.

10.2.2 Provincial and Territorial Regulation

The provinces and territories that fund transit services can achieve some standardization of service policy through their regulations. For example, the funding agencies can refuse to cost-share vehicles and facilities that are not accessible. In British Columbia, all new transit vehicles purchased by BC Transit for use in any community are now accessible. Ontario municipalities are required to develop broad-based accessibility plans to remain eligible for transit funding.

The agencies that fund transit services can also provide incentives to use alternative modes. For example, Quebec requires that taxis be given a role in accessible paratransit services.

10.2.3 Accessible Service Policies and Customer Appeals

In all provinces and territories except British Columbia, the service policies are made at the local level of government within the provincial constraints noted above. In British Columbia, transit services are operated in accordance with policies and procedures established by BC Transit. The regional transit commissions and the municipalities are consulted on local service levels and fares.

In most provinces, customer appeals are first addressed to the service operator, then to the local level of government. The provinces of Quebec, Ontario, and Alberta require that an appeal process be in place. In British Columbia, consumer advisory committees review service complaints but have no authority to implement their findings.

10.3 Family of Accessible Urban Services

An intensive examination of the diverse mobility needs of seniors and persons with disabilities by several provincial funding agencies led to the conclusion that only an approach involving a family of accessible transportation services would adequately satisfy all needs (Atkinson, 1993). Such an approach has become the service-delivery policy in Alberta, Quebec, British Columbia, and Ontario. A family of services could include:

- accessible fixed-route rail and bus transit services for the larger communities and for links between communities;
- a provision for accessible bus routes designed to meet special needs, particularly during off-peak periods or in areas of low demand (e.g., Community Bus);
- a variety of door-to-door paratransit services to meet the needs of persons with disabilities;
- accessible taxi services.

The approximate relative costs per passenger trip of the above services are shown in Table 10.1.

10.3.1 Accessible Fixed-Route Transit

Fixed-route transit services have the advantage of being predictable and easy to understand. They offer spontaneous service usually not available from paratransit operations; this is an important consideration to the passenger with a disability who wants to remain independent. They also constitute an important service component for seniors and the more ambulatory persons with disabilities. Even persons who are blind can learn to use such a service.

Transit systems in most provinces are beginning to procure accessible low-floor buses when replacing their existing vehicles. This is encouraging the major manufacturers to switch production to a standard accessible model. Using such vehicles to make fixed-route transit more accessible will relieve growth pressures on the existing handivan and handibus services.

10.3.2 Paratransit Service Planning

To date, there has not been a comprehensive, authoritative publication on the overall design of paratransit systems. Rather, there are numerous individual publications dealing with various aspects of their design, operations, and monitoring (DS-LEA and MANOP, 1988; IBI, 1988; MANOP, 1993).

While conventional transit services are becoming much more accessible to seniors and persons with disabilities, some form of personalized doorstep transit service on demand will always be needed for the following reasons:

- Passengers with severe disabilities and any other persons who need assistance in boarding and transferring may not be able to use bus stops, particularly in winter conditions.
- Passengers may need assistance in overcoming threshold barriers at both origins and destinations.
- Residences and public buildings provide shelter from inclement weather; many bus stops do not.
- For safety, some passengers may need to be assisted between the vehicle and their destination.

The steps in planning for such service are similar to those for conventional fixed-route service. They involve:

- determining customer needs;
- establishing service standards;
- establishing system parameters;
- selecting appropriate technology;
- designing monitoring and control systems.

Customer Needs

It is important to realize that the market segment for paratransit service is less homogeneous than that for conventional fixed-route transit. Customers for paratransit include seniors with impaired mobility and persons with a variety of physical, medical, and mental disabilities (sometimes in combination). The service must, therefore, be planned to accommodate a variety of mobility aids, ranging from prosthetic appliances and walking aids to motorized wheelchairs and scooters.

Service Standards

Service standards commonly used to design a paratransit service include:

- maximum variation in pickup times;
- maximum ride duration;

- system ability to confirm trips;
- system ability to insert trips into existing vehicle schedules.

Because demand-responsive transit systems assign drivers to "vehicle tours" rather than routes, pickup times and ride duration are more difficult to predict. Similarly, because trip demand varies by time of day, day of week, and seasonal and weather conditions, acceptance of all requests at all times is unlikely. Most systems establish guidelines (including the amount of advance notice required), which are expected to be followed under normal or average conditions.

System Parameters

Paratransit services may be designed as sole systems, as feeder systems, or as part of integrated networks. As sole systems, they provide collection and distribution as well as line-haul services. They may operate a variety of fixed-route and/or demand-responsive services (booked in advance), depending on customer needs and concentration of demand. Where line-haul bus or rail systems are accessible, paratransit services may act as collectors and/or distributors.

Many paratransit services use service zones based on geographic boundaries and travel patterns. Typically, these are based on the area that can be covered in a 30-, 40-, or 60-minute vehicle tour.

Selecting Technology

Paratransit systems use a variety of vehicles, including taxis, as well as sophisticated communications systems and data-processing technology. In large systems, computer-assisted scheduling and dispatching are required to keep track of customer needs and trip assignments. Even small systems must use techniques to manage significant quantities of data and to ensure effective telephone and radio communications systems. Taxi technology is discussed in Chapter 9 and customer communications technology in Chapter 5.

Monitoring and Control Systems

Operators of paratransit services must monitor system performance to maintain productivity (rides per hour of service) and customer satisfaction. The key factors include:

- vehicle occupancy rates;
- number of service refusals;
- number of trip cancellations;
- number of "no shows";
- number of customer complaints;
- number of customers who are unable to access the service.

Systems that are able to change or insert trips just prior to operating a vehicle tour generally have higher productivity and customer satisfaction. Systems that require trips to be booked more than 24 hours in advance experience more cancellations and no-shows.

10.3.3 Community Bus Services

The community bus concept is a fixed-route bus service for everyone; it uses small accessible buses designed to meet the needs of seniors and customers with disabilities. The concept began in Sweden, and similar services have recently been established in Alberta and Ontario. It has received favourable reviews and has recently been implemented as a demonstration project in Vancouver.

Community bus services are, as the name implies, designed to meet local neighbourhood needs. They are usually designed to connect residential areas to local shopping, medical, and social/recreational activity centres. When employed as semi-fixed routes (fixed in time and at activity centres), they have the flexibility to "detour" to pick up customers who are disabled. Community bus routes are generally less expensive to provide per passenger served than doorstep services, but more expensive per passenger than fixed-route transit.

10.3.4 Brokerage Systems

Brokerage systems, such as DATS in Edmonton, can provide a broad range of special transit services. Customers are screened for eligibility. If eligible, they pre-register for the types of trips they need. Manual or computer files are used to retain trip needs and trip histories. When customers call requesting trips, they are assigned to the service that best matches their needs. This may be a shared-ride taxi, a van, or a bus, depending on the availability of vehicles. This distribution of trips among various public and private providers is similar to the distribution of trips by private taxi brokers.

Brokerage systems are very cost-effective because they can contract in advance with taxi firms for flat rates and distribute trips to maximize the vehicle load. They can use the least-cost service that meets a customer's needs.

10.3.5 Service Integration

To achieve the benefits of a more formal brokerage system without integrating all the services, one agency acts as a single point-of-entry for all transportation needs.

Customers are screened by this agency and referred to the most appropriate provider, eliminating the need to register again with an individual provider. This reduces the administrative burden on the service providers so that more trips can be accommodated. Central information systems benefit mainstream users of transportation services as well as those with special needs. A wider range of customers can be served, including those needing service trips to take children to daycare, for example. The system requires that cost-sharing agreements be drawn up between funding agencies. The city of Red Deer, Alberta, has taken steps to establish such a central clearing point for all transportation services for seniors and persons with disabilities (Atkinson, 1993).

10.4 Transit Technology

10.4.1 Adapted Buses

Lift-equipped vans and small buses have been in service in Canada for more than two decades. Over the years the lift mechanisms have been refined and they are now safe, reliable, and not too costly to maintain. They can be installed on vans, school buses, and transit buses.

The concept of lifts on full-sized urban buses initially met with strong resistance from transit operators. Generally, the lifts that could be fitted to a bus of monocoque construction were expensive and difficult to maintain, and the boarding time for passengers using the lifts was a concern. However, this was the only technology available in Canada in 1989, when BC Transit and the Vancouver Regional Transit Commission began to implement the new policy of providing fully accessible bus service.

BC Transit and the Transportation Development Centre (TDC) carried out a study in 1994 to evaluate lift-equipped, high-floor transit buses and ramp-equipped, low-floor buses. The principles of the two access systems are very different. In the older transit buses, the lift must elevate a wheelchair and its user about 75 cm from curb level to bus floor level. In the newer low-floor buses, the ramp forms a sloped bridge between the curb and the bus floor for a passenger in a wheelchair, thanks to the kneeling feature, which reduces the boarding height to 10 cm (Geehan, 1995b).

The evaluation of a lift-equipped bus indicated a much higher technical complexity, a longer boarding time, higher maintenance costs, and an interruption of service if the system fails. The ramp is a much simpler device; it shortens boarding time, has lower maintenance costs and, on the New Flyer buses, can be manually operated if the hydraulic system fails; service interruption is thus eliminated.

10.4.2 Low-Floor Buses

Purpose-built, small, low-floor buses were initially developed in Canada for paratransit service. Ontario Bus Industries Ltd. began production of the Orion II in 1984. This was followed by Overland Custom Coach Inc.'s production of the ELF, a mid-sized, low-floor bus. A larger version of the ELF has also been developed. New Flyer Industries Ltd. began production of a full-sized, low-floor bus in 1992.

European bus designs have had lower floor heights than North American buses for many years. Current low-floor designs, with entrance/exit step heights of 32 cm and interior floor heights of 34 cm, are available. Sales of this type of bus in Europe were projected to be 85 percent of urban transit bus production in 1992.

In August 1991, a status report on low-floor buses was given at the 49th International Congress of the International Union of Public Transport (UITP – Union Internationale des Transports Publics) (Prentice, 1992). The UITP defines a low-floor bus as:

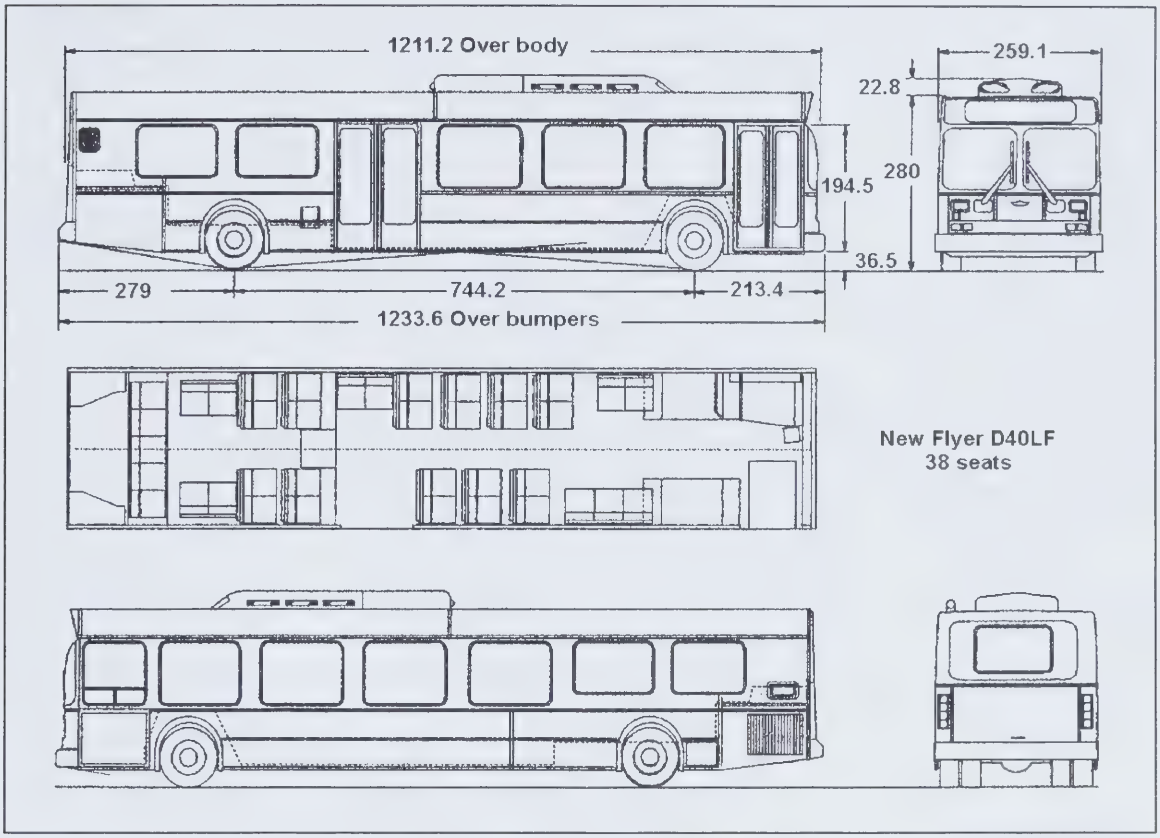
> a bus which, between at least doors 1 and 2, has a vehicle floor sufficiently low and level enough to remove the need for steps in the aisle both between these doors, and in the vicinity of the doors.

Accessible, low-floor, full-sized buses were first placed in service in Victoria, B.C., in May 1992. Since then, a number of Canadian cities have purchased low-floor buses, but not all of them are accessible to passengers in wheelchairs. Low-floor New Flyer buses (see Figure 10.1) are in operation in Kitchener, Ont.; Vancouver, Victoria, West Vancouver, and Penticton, B.C.; Winnipeg, Man.; and St. Albert, Edmonton, and Calgary, Alta. Other low-floor buses on the market include one by Nova BUS (see Figure 10.2) and another by Orion Bus Industries Ltd. (formerly Ontario Bus Industries Inc.). By the fall of 1994, an estimated 150 low-floor buses were in service in Canada and 200 were on order for delivery in 1995.

In November 1992, the Canadian Urban Transit Association (CUTA) sponsored a Bus Design Study Workshop to discuss the use of low-floor buses, to share information from a variety of sources, and to identify particularly important issues and concerns.

The workshop highlighted the need to develop a better understanding of perceived concerns about the design of these buses, and to develop a consensus on low-floor bus design requirements for use by transit systems across Canada.

TDC and CUTA jointly sponsored a project to identify key issues related to vehicle design and to develop specification guidelines for low-floor buses. The final report (Prentice and Kershaw, 1994) identified a number of key design issues related to passenger capacity reduction, interior steps, drive-train configuration, ventilation and heating system, fare collection, door control, fuel capacity, and mobility-aid location and securement.



(Dimensions in cm)

Figure 10.1 Example of a low-floor urban bus design (standard transit vehicle)
(New Flyer Industries Ltd.)

In 1992, the Canadian Standards Association (CSA) published a revised standard, CAN/CSA-D409-92, on *Motor Vehicles for the Transportation of Persons with Physical Disabilities* (CSA, 1992). This standard exempts vehicles with a GVWR of 10,000 kg and over, which includes the majority of conventional urban transit buses. However, Ontario Regulation 629 was originally drafted by the Ministry of Transportation of Ontario (MTO) to ensure that the CSA standard applied to all sizes of vehicle. Because of the controversial nature of this issue, the MTO conducted a study to examine the safety, operational, and economic issues associated with the operation of low-floor buses. The results of the study are not yet available.

The 1994 BC Transit and TDC study concluded that low-floor bus service is a less expensive option (by about 3 percent) for providing accessible service than lift-equipped bus service, and that there were no major operating or maintenance problems with low-floor buses. Furthermore, low-floor buses offer a large number of qualitative benefits, including ease of access for all passengers, which make them the preferred method of providing accessible transit services in Canadian cities (Geehan, 1995b).

Figure 10.2 Low-floor urban bus prototype
(Nova BUS Corporation)

10.4.3 Wheelchair Securement and Passenger Restraint

Wheelchair securement systems in Canadian urban buses are mainly of two types: the wheel-rim clamp and the angled stop with securement belts. In both cases, the passenger faces forward. Both systems secure the wheelchair with belts and hooks attached from rear anchor points to the rear or front of the wheelchair frame. These systems secure the wheelchair against forces that occur during regular transit operation, including severe braking and cornering. No accidents have been reported to date, which would confirm the adequacy of these systems. In most cases, the securement systems are combined with a passenger restraint (lap) belt; generally, its use is mandatory only for passengers under 16 years old. Both require the help of an assistant/companion to deploy the hooks and belts, and to apply tension to the belts. The final responsibility for securement usually rests with the bus driver.

10.4.4 Communications Systems

Transit communications technology is evolving rapidly (see Section 5.2). The new "smart card" systems will facilitate fare collection and make it easier for elderly and disabled travellers to pay. Such systems can log passengers from their origin to their destination.

On-board systems under development include a visual communication system that provides stop announcements and emergency information to passengers, both visually and orally (see Section 5.2.3).

10.4.5 Scheduling Technology

Coordinating paratransit and accessible fixed-route transit services could improve service to customers and reduce costs. New software tools, by companies such as Trapeze Software Inc., TransView, Giro Inc., and International Road Dynamics, are beginning to appear on the market. They combine the management of fixed-route, flexible-route, and demand-responsive transit types into one integrated system, and make it possible to offer centralized dispatching and one-stop customer information and trip planning for all transit services.

It is reasonable to expect that the future will bring an increase in the integrated management of different types of services. This integration will be extended to other transportation modes, making it possible to create custom-made travel plans to meet each customer's criteria. The customer might specify the minimal trip time and distance, with the fewest transfers, at the lowest overall cost. High accessibility is necessary for persons with physical, sensory, or intellectual disabilities. Other criteria include maximum availability, quality of amenities, and scenic interest.

10.5 Guidelines for Planners and Designers

The discussion of urban bus transit in this chapter has focused primarily on means of making existing transit services accessible. For communities on the threshold of implementing transit service, the discussion in Chapter 12 may be more relevant. These communities and others may wish to consider alternative methods of delivering accessible bus services, such as the integration of school bus services. Such alternatives are discussed in the Community Transportation Review guidelines published by the Ministry of Transportation of Ontario (Ontario, 1993). Service planners who need to consider urban bus transit in greater depth should consult:

- Section 6.3 for safety issues and requirements;
- Sections 7.3 and 7.4 for bus-operator training programs;
- Section 12.4 for the deployment of buses in rural services;
- Section 17.2 for multimodal travel requirements;
- CAN/CSA-D409-92 on *Motor Vehicles for the Transportation of Persons with Physical Disabilities*, Z604-95 on *Transportable Mobility Aids*, and Z605-95 on *Mobility Aid Securement and Occupant Restraint Systems;*
- The regulations and guidelines provided by the provincial government funding agencies in Canada;
- The Canadian Urban Transit Association (CUTA);
- CUTA's provincial equivalents, such as the Ontario Urban Transit Association (OUTA).

The following guidelines come from a number of low-floor bus studies (Rutenberg, 1993b; Prentice and Kershaw, 1994; Rutenberg, 1994a; Rutenberg, 1995c):

- The width of entrance doorways must be at least 75 cm clear.
- Handrails and grabrails at both sides of the door should be in contrasting colours.
- The step edge should be in a contrasting colour (chrome yellow).
- All stanchions should be in a contrasting colour.
- A ramp for wheelchairs should be provided at one entrance door (front or centre).
- One or two positions should be provided for wheelchairs.
- The bus-floor finish should be of non-slip material.
- The fare-payment system should be based on coin, pass, electronic (debit, proximity, or smart card), or free-ride principle.
- The buses should have a kneeling front suspension.
- "Priority" seats should not be in the same area as the securement system.
- The securement system should not require driver involvement.
- A forward- or rearward-facing position for passengers in wheelchairs should be decided upon.
- If passengers in wheelchairs face to the rear, some other seats in the bus should also be rear facing.
- The destination/route signs on the outside of the bus should be visible from the front, side, and rear.
- The stop-request signal activator should be accessible to a passenger in a wheelchair.
- "NEXT STOP" should be displayed in text and audio mode.
- Seniors and passengers with sensory disabilities should have priority seats near the driver for better communication and access to an exit door.

- In a face-to-face seating arrangement, front-facing seats must have hand- and grab-rails.
- The local operating authority should establish a policy on the use of passenger restraints and securement for wheelchairs in consultation with the customers using mobility devices.

A rear-facing compartment should have an aisle-facing stanchion and a horizontal handrail. A passenger in a wheelchair should make contact with the back-support panel and apply the wheelchair brakes. A large button/area strip control to request a stop should be provided within easy reach.

Other more general recommendations include the following:

- Information brochures should be made readily available.
- A visual route map should be provided in the bus.
- Signs should be improved to conform with the human factors discussed in Chapter 5.
- A public address (PA) system should be provided for drivers.
- Colour-contrasted markings should be provided on interior steps.
- Tactile markings should be provided.
- The exit-opening mechanism should be improved.
- Bus operators should receive sensitivity training.
- Courtesy seating should be improved.
- "Real-time" information systems should be considered.

- 11 -

URBAN RAIL SYSTEMS

- 1 - INTRODUCTION

CUSTOMER ACCESS

- 2 - TRIP PLANNING	- 3 - ROADWAYS & TERMINALS	- 4 - PERSONAL VEHICLES

SYSTEM ACCESSIBILITY

- 5 - COMMUNICATIONS SYSTEMS	- 6 - SAFETY & RELIABILITY	- 7 - TRAINING	- 8 - RESEARCH & DEVELOPMENT

PUBLIC CARRIERS: LOCAL

- 9 - ACCESSIBLE TAXIS	- 10 - URBAN BUS SYSTEMS	**- 11 - URBAN RAIL SYSTEMS**	- 12 - RURAL SYSTEMS

PUBLIC CARRIERS: INTERCITY

- 13 - AIR TRANSPORT SYSTEMS	- 14 - INTERCITY RAIL SYSTEMS	- 15 - INTERCITY BUS SYSTEMS	- 16 - MARINE SYSTEMS

- 17 - MODAL INTEGRATION

Related Information: Commuter rail systems are discussed in Chapter 14.

11 Urban Rail Systems

Canada has four basic types of urban rail-transit systems: two types of light rail transit (LRT); automated-guideway transit (AGT); and the full-scale heavy-rail transit (HRT) systems commonly known as "subways" or "metros". These systems vary in their degree of accessibility, depending on when they were designed and built. Newer systems are generally more accessible.

Examples of the technology include:

- Toronto's unique street railway and LRT system, which provides a cross-town collection and distribution service within the high-density city core;
- the full-scale LRT systems serving Edmonton and Calgary;
- the AGT systems serving the Vancouver Region and Scarborough Town Centre within the Toronto region;
- the HRT systems operating in the Montreal urban community and in Metropolitan Toronto.

At present, the AGT system in the Vancouver region and the LRT system in Calgary are accessible. The Toronto HRT system and the Edmonton LRT system are partially accessible. The Toronto Transit Commission (TTC) is in the process of a major system upgrade to improve accessibility to the subway (see Section 11.3.1).

Statistics on the use of urban rail-transit systems by persons with disabilities are aggregated with bus-transit services in the TransAccess™ Information Base (see Chapter 10).

11.1 Accessibility Issues

From the customer's point of view, each link or component of a transit trip must be accessible. This includes feeder buses and taxis that serve a rail terminal, automobile parking and drop-off areas, entrances to the terminal, fare-collection systems, washrooms, service kiosks, boarding platforms, and passenger railcars.

11.1.1 System Barriers

The single most difficult access barrier to metro and subway systems is the vertical level change. Toronto has retrofitted or equipped stations with escalators and elevators, but this is very costly. A more economical solution has been used in Japan, where escalators are outfitted with a platform on which wheelchairs can be transported.

Generally, the HRT systems in Canada are not fully accessible. The system in Toronto became partially accessible in 1996. An ergonomic study identified the major tasks that challenge potential customers of accessible urban rail systems (Arnold, 1993).

Paying the Fare

Paying the fare can be challenging for customers who are blind or visually, physically, or learning disabled. For most subway and light-rail transit systems, information about fares is provided in a small-print visual format, making it impossible for persons with visual disabilities to obtain the information on their own. In addition, many learning-disabled customers find zone systems for fares difficult to understand. Systems, such as the one in Vancouver, which automatically tell the customer how much to pay after a few simple selections, are well received by persons who are learning disabled. Confusion may arise if too much information is provided at one time.

On systems where the customers pay their fares just before boarding the railcars (e.g., Vancouver, Calgary), rather than when they first enter the terminal (e.g., Toronto, Montreal, Edmonton), it is often difficult to find an attendant to ask about the correct fare. Many customers are unable to make the correct fare decision on their own. Persons who use wheelchairs may have difficulty reaching the fare-collection system.

Boarding a Railcar

Unless the terminal platform and the railcar floor are at the same level, boarding represents a problem of varying degrees for all passengers with disabilities.

Tasks that can be particularly difficult for passengers with sensory and cognitive disabilities include determining the appropriate railcar boarding location; getting to the platform; negotiating platform ramps; identifying the railcar entrance; deploying retractable ramps; determining whether the railcar entrance is about to close; and determining the mechanism for entering the railcar (on some user-activated systems). Customers with visual disabilities need tactile cues and audible cues to help them find the proper place to board.

Long flights of stairs and fast-moving escalators are troublesome. Customers with physical disabilities may have strength, stamina, and balance limitations, and may have difficulty climbing the steps on street-level railcars. Passengers who use wheelchairs may have problems with ramped platforms at suburban LRT terminals. Numerous grade changes can create problems for customers whose strength is limited.

Moving Within a Railcar

Moving within a railcar can be difficult for persons with limited mobility, particularly those in wheelchairs, if the aisle is not wide enough and the places for wheelchairs are not close to the entrance/exit doors. Seniors have noted that handrails would help them to get in and out of the seat.

Moving within a railcar is also difficult for customers with visual disabilities because they cannot see what is directly in front of them. Persons with visual disabilities rely on cues such as contrasting colours on hand-holds, stanchions, and stairs. These customers often remain close to the entrance doors if such aids are not available.

Locating a Seat

Most rail systems have courtesy seats available to customers who have disabilities, but these seats are not consistently placed in railcars. Signs designating courtesy seats are often very small, and not in a tactile format. The pictograms used to designate courtesy seating may not be consistent between different railcars. Furthermore, the colouring used for courtesy seats is usually the same as that used for all other seats. Often, there is inadequate space for guide dogs to lie down underneath the seats. This forces the dogs into the aisles where they may interfere with passenger movement.

Understanding Route Maps

In terminals, route maps and electronic signs are usually placed over platforms to indicate the route and direction of travel. Customers with visual and learning disabilities often have difficulty in finding the correct boarding location in terminals with more than one rail line. To date, no system in Canada provides information about boarding locations in a tactile or audio mode to help persons with visual disabilities. The TTC route map is considered an example of good design.

Obtaining Information about On-Board Regulations

This information is usually provided only in a visual format on signs often located above eye level, creating difficulties for customers with visual disabilities. On-board regulations are not given in either auditory or tactile format. Some wheelchair passengers may have difficulty reading signs that are too high, with letters and symbols that are too small.

Information is not presented consistently on different regulatory signs. Some signs use printed words (e.g., "Please stand clear of the doors") and others use pictograms (e.g., the no-smoking sign). Customers who cannot read miss important pieces of information when it is provided only in printed form (Canadian Urban Transit Association, 1996).

Deboarding a Railcar

Deboarding a railcar can be difficult for passengers with sensory and cognitive disabilities. The problems include determining where the railcar is and how far it is to the destination; identifying the desired terminal; and determining the appropriate railcar exit.

Route maps, terminal signs, and on-board indicators can provide information about the location of the railcar. Some subway and light-rail transit systems have all three of these information systems in place, but most do not have regular auditory announcements. Despite the information provided, many passengers with sensory and cognitive disabilities have difficulty identifying their exit terminals.

Difficulties may arise for people who are blind when no auditory information is provided on board the railcar. These persons have to resort to counting stops, a not entirely reliable method. Passengers with visual disabilities also find it difficult to read terminal signs outside the railcar, particularly at night, if they are too small, have poor contrast, are not well-lit, or are obscured by glare. Terminal signs are often lost among advertising signs and they are often not repeated enough.

People who are hard of hearing have difficulties determining their correct exit terminals because announcements are often not loud enough to be heard over background noise, and computer-generated voices are not easily understood.

Persons with learning disabilities may have trouble with the colour schemes used on the route signs. Even though different colours are often used to designate different rail transit routes, some learning-disabled customers are unable to distinguish them.

Some visually or learning-disabled passengers have difficulties determining the location of the appropriate exit, particularly the correct side of the railcar to exit from, and most systems do not provide this information. Even though most doors open automatically, some people do not have enough time to react if they do not know in advance which doors they need to exit from. This can be especially difficult in railcars with only a few passengers, since auditory cues are then limited. When a railcar is crowded, it may be difficult for passengers to position themselves on the correct side to exit if they do not have any advance warning.

Public Announcements

Public announcements are often difficult to understand. They are often made when ambient noise levels are high, such as during braking. Furthermore, sound quality is generally quite poor, and parts of announcements are sometimes missed because of malfunctions with the play-back system.

Computer-generated announcements are particularly difficult for learning-disabled passengers to understand. Often announcements are not made far enough in advance of the terminals for these people to react. During a simulation, one

learning-disabled participant was unable to identify the correct stop even though announcements were made and visual information was available on route maps and terminal signs (Arnold, 1993).

Carrying Out Emergency Procedures

Carrying out emergency procedures on a rail-transit system can be difficult for passengers with physical, sensory, or cognitive disabilities. The main problems are identifying the emergency systems and knowing how to use them.

Generally, two types of emergency systems are used on rail-transit cars: emergency strips, which send a one-way signal to the control terminal when they are pressed; and intercoms, which allow communication with either the driver or an attendant in the control terminal. Most railcars have one of these devices, but some have both (e.g., SkyTrain in the Vancouver region).

Some railcars have clear information about emergency procedures on large, easy-to-understand signs. Although these signs are generally not used during an actual emergency, they do provide the information for people to read in advance if they want to be better prepared. One difficulty is that signs are not always placed at eye level, making them difficult to notice. Wheelchair customers may not be able to see the signs (see Chapter 6 for further discussion of safety issues).

11.1.2 Selecting Technology

Urban rail systems are designed to move large volumes of passengers along medium-to-high density corridors between major activity centres. The important considerations when selecting rail technology include the following:

- peak capacity in passengers per hour per direction;
- compatibility with existing and future urban land-use patterns and the urban geography;
- impact on the existing transit network;
- total system cost, including land costs;
- social, economic, and environmental impacts;
- overall system accessibility.

At present, the technology ranges from street railcars, which can handle 6,000 passengers per hour per railcar (12,000 in tandem), to full-scale HRT systems with capacities of 40,000 passengers per hour per route. In the middle range are the LRT systems, which can handle 10,000 to 25,000 passengers per hour (CUTA, 1993).

Many factors affect the overall accessibility of rail systems:

- the degree to which the system is grade-separated from other traffic;
- the land-use and cost constraints that may require considerable grade separation at terminals, i.e., vertical designs to conserve land;
- the availability of land for parking and drop-off facilities;
- the types of railcars selected, e.g., low-floor or not; and the interior layouts;
- the design of terminal platforms required to access the floor of the railcars;
- the quality of integration with other modes of travel, i.e., automobile, taxi, paratransit, and buses;
- the number of transfers required to complete a trip;
- the accessibility of the terminals;
- the information and communications systems used;
- the safety and security of the system.

The challenge facing transit planners and designers is that, in most systems installed prior to 1980, the terminals were not designed for accessibility. Because rail systems have a very long service and investment life (50 years or more), they simply cannot be torn up and rebuilt. This situation has resulted in some extensive terminal modifications (for example, the TTC upgrades).

The systems and terminals built since 1980 are generally accessible. European technology has been used in the Alberta LRT systems. Low-floor street railcars are also available from European sources. The Canadian AGT technology can also be made fully accessible.

A considerable amount of work is under way to improve the accessibility of fare collection, barrier-control systems, and customer communications. Turnstile bypass systems are being used for persons in wheelchairs. In 1995, the TTC developed a new design for an extra-wide exit turnstile suitable for persons in wheelchairs, and in-service testing began in 1996. Several systems, such as those in Edmonton, Calgary, and Vancouver, use honour fare systems to avoid fare-control barriers. The Toronto subway system allows transfer passengers to bypass turnstiles during peak periods.

11.2 Regulation

Rail transit systems are generally regulated in the same manner as bus transit systems (see Chapter 10), with one exception. Most provinces enacted railway legislation at the time that street railway systems were being introduced. This provincial legislation addressed safety issues and standards.

The cities that operate rail systems within the street network have enacted local by-laws that govern right-of-way issues.

11.3 Accessible Urban Rail Technology

Canadian manufacturers of transportation equipment depend heavily on export markets, particularly those in the United States. This has led to universal designs that meet the requirements of the Canadian transit systems as well as the Americans with Disabilities Act (ADA), and the guidelines and regulations that flow from the legislation enacted by Canada and the United States.

Canadian consumers benefit from the accessibility legislation in two ways:

- Standardized, universal designs for accessible railcars are being produced by Canadian manufacturers for use in urban and commuter services.
- The availability of accessible railcars is encouraging Canadian carriers to make their terminal facilities more accessible.

11.3.1 Partially Accessible Rail Transit in Toronto

In 1990, the TTC initiated a major policy review of how best to provide mobility for seniors and persons with disabilities to the year 2000. The study, which included a public consultation process, began with an evaluation of the effectiveness of existing TTC programs and policies (TTC, 1989).

The review identified a number of initiatives that could be undertaken to improve mobility for customers with disabilities:

- making key subway terminals accessible in the short term;
- making all terminals accessible in the long term;
- using kneeling buses;
- providing accessible "community bus" service;
- installing additional escalators in subway terminals.

The TTC adopted the following recommendations:

- make all new terminals accessible;
- retrofit 20 key terminals with accessibility features (including elevators) over 10 years;
- implement a new escalator/elevator policy, including an escalator improvement program;
- perform a general upgrade to make the system more accessible to all.

The upgrades include a wide range of features: wider terminal entry-ways, automated doors, additional benches with a more accessible design, handrail modifications, chime signals on trains, wayfinding floor tiles, extended end-gates on

railcars, priority seating signs, emergency door barriers, contrasting door thresholds, high exit turnstiles, enlarged coin slot and modified height of token vending machines, accessible washrooms at key stations, elevators, lower fareboxes, wider subway car doors, and wheelchair positions with clamps. Bright yellow stair-railings, station benches with arm rests, and tactile strips at the platform edges have become standard in most terminals ("Accessibility", 1994).

By 1996, two of the new subway terminals were accessible, the T-1 railcars were in the last stages of testing, and elevators had been installed in the Bloor/Yonge terminal and in Union Station. In January 1996, it became possible for the first time for a person in a wheelchair to make a round trip on the TTC subway. The new railcars have wide doors and wheelchair positions with flip-up seats (see Figure 11.1).

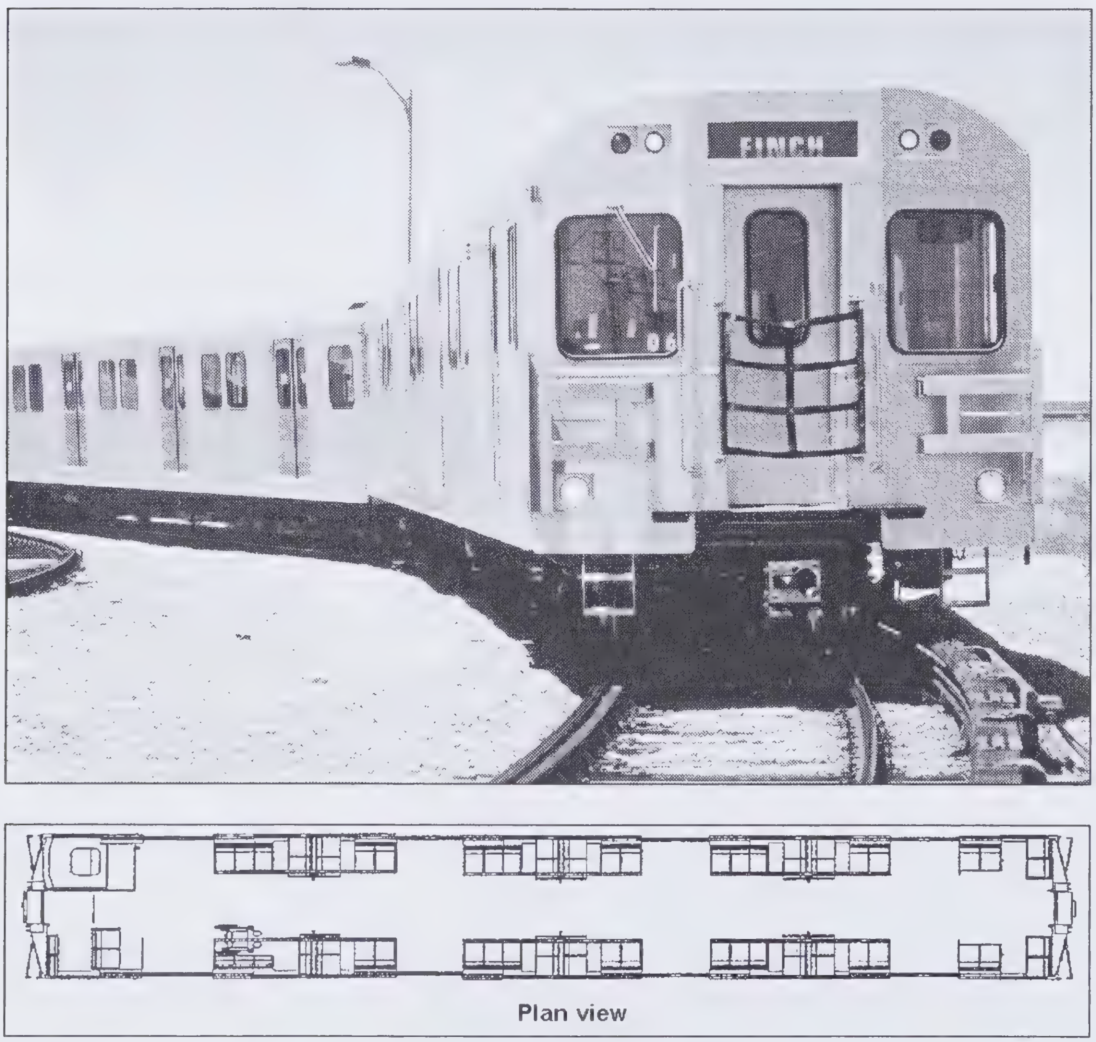


Figure 11.1 New T-1 accessible railcar for Toronto
(Bombardier Inc.)

11.3.2 System Improvements in Montreal

For the last decade, the Montreal Urban Community Transport System/Société de transport de la Communauté urbaine de Montréal (STCUM) has been pursuing a program of making the Metro system more accessible to seniors and ambulatory persons with disabilities. At present, the system is not considered accessible to persons who use wheelchairs. The STCUM has undertaken the following terminal improvements:

- extended stair-railings with touch-sensitive indicators at the end;
- contrasting colour strips marking the first and last steps in stairways;
- removal of obstacles and barriers;
- installation and testing of improved passenger communications devices.

The STCUM has also implemented Telecite's on-board automated communications system, which provides announcements and emergency information to passengers in both visual and audible formats (Moreyne, 1992). Animated colour graphics and continuous programming keep passengers updated on news, weather, sports, cultural events, and other items of educational interest (see Chapter 5). Information is communicated with a digitized voice. The objectives are to assist persons with disabilities and to improve communications with all passengers.

11.3.3 Calgary LRT (C-Train) System

With the completion of ramp construction at the Anderson and Victoria Park/Stampede stations in 1996, all station platforms on the LRT system are wheelchair accessible.

The downtown platforms are accessed by a short ramp and stairs; stations on the northeast and northwest lines have ramps, escalators, and elevators. On the south line, new grade-level pedestrian crossings and ramps have been constructed at Erlton/Stampede, Chinook, Heritage, and Southland stations to provide alternative access to the platform.

All ticket machines and "help" phones in the stations are wheelchair accessible. C-Train park-and-ride lots have designated parking for persons with disabilities who travel by automobile. Persons who use these stalls must display a special parking permit, issued by an Alberta registry office.

The Calgary LRT system has the following special features:

- The centre door on each C-Train car is marked with a wheelchair decal, and the vertical grab bar in the doorway has been bent to allow wheelchair access.
- A priority-seating area for persons with limited mobility has been designated beside C-Train doorways.

- An important transit safety feature is the Transit Help Intercom System (THIS). The system is located in every C-Train car, in stations, and on platforms. THIS enables transit customers to get help immediately in emergency situations, such as a medical emergency, harassment, vandalism, fire, or smoke.

11.3.4 Edmonton LRT System

The downtown portion of the Edmonton LRT system is underground, and is connected to most destinations by a system of walkways and elevators in adjoining buildings. An extensive customer outreach program is under way to explain the accessibility features of the transit services (Edmonton Transit, 1995b).

Passengers who use wheelchairs are directed to the centre railcar doors where the vertical grab bars have been bent to facilitate access. Edmonton Transit is testing a retractable ramp to correct a small variance in height between railcar floors and station platforms. Space is allocated just inside the centre doors for wheelchair passengers. Wheelchair securement systems are provided.

11.3.5 Vancouver Region AGT System

The SkyTrain AGT system, which serves the Vancouver region, is fully accessible and integrated with other accessible rail, marine, and bus services. Figure 11.2 illustrates the technology used. For a detailed description of Vancouver's accessible transit services, see Section 17.3.

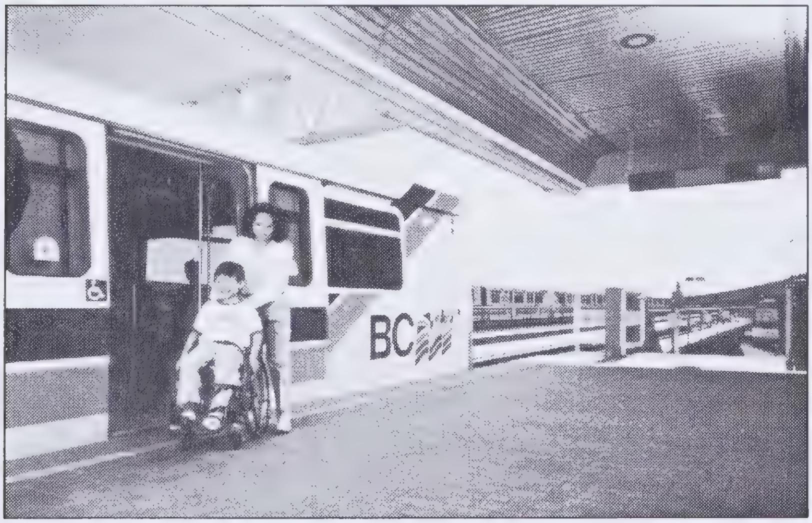


Figure 11.2 Fully accessible SkyTrain technology in Vancouver
(BC Transit)

11.4 Guidelines for Planners and Designers

Table 11.1 presents a summary of the infrastructure and customer-service improvements that should be considered to accommodate seniors and customers with disabilities. For the more detailed planning and design information needed to develop accessible rail services, consult the following:

- Section 3.3 for pedestrian access, Section 3.4 for terminal requirements, and Section 3.5 for human factors in design;
- Section 5.2 for communications media and technology;
- Sections 6.3.2 and 6.4.3 for safety requirements;
- Section 7.6 for staff training programs;
- Section 8.8 for current research and development projects;
- Section 17.2 for multimodal travel requirements;
- Canadian Standards Association CAN/CSA-B651-95 on *Barrier-Free Design*;
- Carriers that have developed specialized accessibility technology, including airlines, GO Transit, VIA Rail, the Greyhound Group of Companies, and the urban rail transit systems in major cities.

Table 11.1 Recommended infrastructure and customer-service improvements

Infrastructure Recommendations

Provide
- protected positions for passengers in wheelchairs
- colour-contrasted markings on steps and platform edges
- tactile and visual route maps
- lighting of 200-300 lux adjacent to signs
- tactile information cues
- electronic signs on board
- tactile markings on stairs and escalators
- an intercom for emergencies
- emergency strips with feedback when activated
- automatic messages on “next terminal”
- emergency announcements

Improve
- signs to conform with human-factors principles
- emergency information systems
- grab bars and handrails

Redesign
- fare-collection barriers

Standardize
- courtesy seating
- door-opening mechanisms

Customer-Service Recommendations

Consider
- tactile signs
- real-time information systems

Provide
- readily available information brochures

Improve
- security provisions
- queuing procedures
- public announcements
- sensitivity training for all personnel

- 12 -

RURAL SYSTEMS

– 1 – INTRODUCTION

CUSTOMER ACCESS

– 2 – TRIP PLANNING	– 3 – ROADWAYS & TERMINALS	– 4 – PERSONAL VEHICLES

SYSTEM ACCESSIBILITY

– 5 – COMMUNICATIONS SYSTEMS	– 6 – SAFETY & RELIABILITY	– 7 – TRAINING	– 8 – RESEARCH & DEVELOPMENT

PUBLIC CARRIERS: LOCAL

– 9 – ACCESSIBLE TAXIS	– 10 – URBAN BUS SYSTEMS	– 11 – URBAN RAIL SYSTEMS	**– 12 – RURAL SYSTEMS**

PUBLIC CARRIERS: INTERCITY

– 13 – AIR TRANSPORT SYSTEMS	– 14 – INTERCITY RAIL SYSTEMS	– 15 – INTERCITY BUS SYSTEMS	– 16 – MARINE SYSTEMS

– 17 – MODAL INTEGRATION

Related Information: The development of accessible taxis, which are frequently used in rural systems, is discussed in Chapter 9.

12 Rural Systems

In absolute numbers, rural transportation systems and services are far more numerous than urban operations in Canada. The Canadian Urban Transit Association (CUTA) estimates that at least 300 organized systems are in place (CUTA, 1993), many operated mainly by volunteers.

Rural transportation services are often delivered through public-private partnerships among local governments, private carriers, advocacy and support groups, and local chapters of national service clubs and associations. Provincial funding policies for such transportation systems vary widely across Canada. Federal assistance in the form of cost sharing for vehicles has been available for two decades.

Although rural transportation systems are custom designed to fit the needs of a particular region or community, they exhibit some common characteristics:

- They are almost always designed to serve the needs of persons with mobility impairments rather than the general population.
- They often serve more than one small community.
- They often use various modes, including local taxi companies.
- They often depend on volunteers to process requests for service and to schedule trips.
- They usually have greater flexibility in service and eligibility policies than their urban counterparts.
- They can function as an embryo or starter transit system.

For the purposes of this guide, rural transportation systems are defined generally as those serving rural areas and urban communities of fewer than 10,000 persons. (In Canada, an urban population of 10,000 persons is often the threshold for some form of transit or paratransit service.) By comparison, in the United States, the term "rural transportation" usually includes service to an urban population of fewer than 25,000 persons, because communities smaller than that rarely provide transit services.

12.1 Accessibility Issues

Rural areas may develop a number of transportation systems and services to meet particular needs. For example, a small community in southern Alberta with a population of under 7,000 persons was found to have six transportation services (MANOP, 1993):

- lift-equipped vans operated by a society of people with disabilities providing scheduled rural collection and distribution;

- automobile shuttle and transfer services operated by a local service club for long-distance medical trips to regional hospitals in two cities;
- a private van service operated by the major seniors' residence for shopping and recreational trips;
- taxi-fare concessions for seniors provided by the local taxi company;
- an auxiliary school-bus service for students not eligible for busing;
- an accessible seniors' van operated by the local hospital for some 20 residents of their long-term care unit.

Collectively, the above services are known as "paratransit" systems. Coordination of these systems, if it exists, usually occurs through the administration of municipal and/or provincial grants (see Section 12.1.2). A more formal method of coordination is to establish a transportation advisory board or committee made up of representatives of the various interest groups in the community.

12.1.1 Service Policies

Transportation service policies are usually a reflection of the organization delivering the service. For example, associations of senior citizens tend to develop systems primarily for elderly persons, while community-action groups and municipal governments tend to respond to broader needs. Service policies include both eligibility criteria and system characteristics:

- eligibility criteria and priorities
- trip priorities
- pricing policy
- hours and days of service
- service area

Eligibility Criteria

The most common eligibility criteria, in descending order of inclusiveness, are as follows:

- All persons may use the service.
- All seniors and persons who are mobility disadvantaged may use the service.
- All customers with disabilities may use the service.
- All seniors and adults with disabilities may use the service.
- Only customers with disabilities may use the service.
- Only seniors may use the service.
- Only persons with special needs may use the service.

Persons who are mobility disadvantaged include people with disabilities and those who do not have access to a private vehicle (e.g., low-income families).

Examples of all of these criteria can be found in Canada, depending on the delivery organization and the method of funding.

Trip Priorities

Most rural systems make vehicles available for service for the following purposes, in descending order of priority:

- medical appointments, including physiotherapy
- shopping and personal business
- social/recreational trips
- out-of-town excursions

Systems that cater to a larger segment of their population (all persons who are mobility disadvantaged) may include the following, with priorities similar to those for medical appointments:

- work trips
- school trips
- service for daycare centres
- hospital visiting
- patient travel for nursing homes and auxiliary hospitals

Most systems offer trips on a first-called, first-served basis, and limit total trips so as not to exhaust available funds.

Pricing Policies

Pricing policies vary widely throughout Canada. Some systems are "free" to the customer. Some provide a vehicle and users are expected to pay the operating costs. Subsidized taxi systems usually collect part of the taxi fare from customers; this amount may vary with vehicle occupancy. Flat-rate fares within zones are most common for bus and van systems. Excursion trips are usually priced differently, depending on whether the driver is paid or vehicles are operated by volunteers.

Hours and Days of Service

The hours and days of service are usually greater for subsidized taxi systems than for bus and van systems, where a dispatcher must be provided by the operator. The van and bus systems usually operate on demand during regular office hours, and must be booked at least 24 hours in advance for trips at night or on weekends.

Service Area

Most rural transportation systems are based in a town or village. Service areas often include the surrounding rural municipalities and nearby towns and villages. Some systems provide a regional service. Quebec has some systems that serve up to 17 municipal jurisdictions.

Scheduling

Subsidized taxi systems generally provide the highest level of service: unscheduled service on demand. The dispatcher quickly becomes familiar with repetitive trips and schedules extra taxis, as needed. Taxis tend to cruise in areas where trips originate (e.g., hospitals, senior citizens' lodges, and activity centres).

Van and bus services are usually scheduled at least 24 hours in advance. Vehicles equipped with two-way radios can accept last-minute requests, but these are not usually accommodated in rural areas because of the lack of back-up vehicles. Some systems require bookings of from one to three days in advance. All systems usually require more notice for scheduling excursion trips.

Customer Appeals

Formal appeal provisions regarding eligibility rules and regulations are not universal. Occasionally an appeal process is provided for in municipal bylaws. In Quebec, provincial regulations require an appeal process as a condition of funding. The political process helps to keep local agencies and municipal councils responsive to local needs. In most cases, a person denied service would likely appeal first to the provider organization and then to the municipal council.

12.1.2 Funding Policies

The major sources of capital funding for rural transportation have included the following:

- federal grants
- provincial grants
- charitable foundations
- local service clubs
- local municipal cost-sharing (often between two or more municipalities)

Apart from fares and donations by service organizations, the current major sources of operational funding are the general revenues of the municipal and provincial governments. The federal Urban Transportation Assistance Program (UTAP) was used to fund services in Manitoba and the Atlantic provinces until

1983. Other provinces elected to use assistance program funding in overall transportation financing.

Federal assistance to purchase vehicles for special needs has been provided to small communities and rural areas under Transport Canada's Accessible Vehicle Acquisition Program (AVAP). Since 1991, substantial cost-sharing for acquiring accessible vehicles has been provided under the National Strategy for the Integration of Persons with Disabilities ("Update", 1995).

With the exception of Saskatchewan, Newfoundland, New Brunswick, and the Northwest Territories, provincial jurisdictions have programs for urban transit assistance funding. Saskatchewan has had programs for rural funding and recently they have been introduced in Ontario.

The substantial variations in the degree of funding assistance provided by the provinces are due to geographic factors such as size and number of urban centres, historical precedence, and differences in priorities and circumstances. The funding policies should be negotiable as circumstances change. Common objectives include:

- to allow residents of rural areas to remain in their own homes for as long as possible so as to reduce the need for institutional residences;
- to provide access to centralized social, recreational, and medical facilities so as to make efficient use of these facilities;
- to provide an acceptable level of independent mobility for seniors and persons with disabilities.

12.2 Regulation

Rural systems are largely unregulated. Few rural municipalities enact local taxi by-laws. Most depend on the provincial vehicles acts and provincial motor-carrier commission regulations governing licensing and insurance requirements for passenger vehicles.

Insurance for private automobiles driven by volunteers has often become a concern in provinces that have not enacted no-fault legislation. Quebec has made provision for insurance coverage for carpools and volunteer services.

12.3 Service Delivery Options

Typical service delivery options for a rural community include:

- private vehicles operated by volunteers
- municipal subsidies to private transportation systems
- service contracts with school-bus operators
- municipal operating agencies

12.3.1 Volunteer Drivers

One of the simplest forms of rural transportation is a roster of volunteer drivers who are available to meet special needs. Such a roster could be maintained by a local service club, seniors' activity centre, or medical facility.

12.3.2 Service Subsidy

In the absence of a formal contract for service, a local municipality or other agency could simply provide a grant or subsidy to a private carrier. Such subsidies are often provided to local taxi and paratransit services, which might not otherwise be financially viable.

12.3.3 Service Contracts

A substantial number of conventional transit services and most of the school-bus and paratransit services in smaller Canadian communities are contracted out. In 1988, for example, 25 conventional systems out of 59 in Ontario were contracted out (Transmode, 1989). In British Columbia, aside from Vancouver and Victoria, all conventional transit systems and all the paratransit systems are contracted out to municipalities, private contractors, or non-profit agencies. In Quebec, a large proportion of the trips for persons with disabilities are contracted out to taxi firms. In the case of systems operating 10 or more vehicles, the municipality usually employs a coordinator to manage the contract. The contractor provides the direct supervision and often the spare vehicles.

12.4 Paratransit Options

An examination of the diverse mobility needs of seniors and persons with disabilities leads to the conclusion that a family of transportation services must be provided if all needs are to be adequately satisfied. Such a family of services could include:

- accessible bus services for the larger communities and for links between communities;
- accessible taxi services, particularly during off-peak periods or in areas of low demand;
- a variety of doorstep handivan/handibus services designed to meet the needs of persons who require door-to-door service and a high level of driver assistance.

12.4.1 Accessible Taxis

For those who can afford them, accessible taxis can provide a high-quality personal service alternative. Once available, such taxis can be used as a back-up service when it is not cost-effective to provide special transit (see Chapter 9).

Rural areas and small communities can use accessible taxis in a shared-ride mode as an alternative to providing accessible bus and van services.

Accessible taxis are not likely to become widely available without encouragement, particularly during current economic conditions. Financial aid to cover the initial capital cost of the vehicles and/or financial incentives in the form of contracts for service are needed. In addition, any constraints on shared-ride operation and flat rates for contract services within municipal by-laws would have to be removed.

12.4.2 Mobility Clubs

Mobility clubs operate like cooperatives with the members (often volunteers) owning the vehicles individually or collectively and providing services to themselves at a minimum cost. A mobility club provides the necessary organization to raise funds, to administer grants, to dispatch private and paratransit vehicles, and to provide insurance coverage.

12.4.3 Dial-a-Ride Handivan/Handibus Service

For the following reasons, some form of accessible doorstep service on demand should be offered:

- Customers may not have access to private modes of travel, particularly during winter conditions.
- Customers may need assistance in overcoming threshold barriers at both ends of the journey.
- Residences provide shelter from inclement weather.
- For security purposes, some customers may need to be attended between the vehicle and their destination.

A number of techniques can be used to make Dial-a-Ride systems more customer-friendly:

- To reduce the time spent in telephone conversations, computer filing systems can be used to retrieve rider data.

- Whenever possible, trips can be accepted on demand to accommodate spontaneous travel.
- Communications technology, such as cellular telephones, can be used when dispatchers are not available.

12.4.4 Community Bus Systems

The community bus concept, developed in Sweden, uses small, low-floor accessible vehicles to provide neighbourhood services in larger communities, and to serve special needs in lower-density areas (Stahl, 1990). In Alberta, a fully accessible community bus service known as SCAT, for Strathcona County Accessible Transportation, was implemented in September 1992 (MANOP, 1993). SCAT provides three services:

- a local community bus route linking seniors' residences with medical and shopping facilities in Sherwood Park;
- rural routes that provide services to the Sherwood Park Mall;
- trips to Edmonton for medical and rehabilitation needs.

By applying route diversion to accessible community bus routes, services can be provided that approach the quality of handibus service while retaining the cost-effectiveness of fixed-route services.

12.5 Guidelines for Service Planners

Formal planning for accessible transportation services in rural communities usually requires a transportation study, yet small municipalities often do not have the human resources necessary to plan and carry out such a study. Most municipalities can develop a data base for a transportation study with assistance from consultants and others familiar with the needs – often volunteers. The following sections describe how to develop such a process.

12.5.1 Working with Volunteers

Rural transportation systems depend largely on volunteers, particularly in the early stages of their development. Useful guidelines are given in *Volunteer Transportation Service Coordinator's Manual* (Ontario, 1992) and *Succeeding with Volunteer Transportation* (Studebaker, 1990).

The 160-page Ontario manual provides detailed advice on starting a volunteer transportation service, recruiting volunteers, developing service policies, and training drivers.

The Studebaker manual is based on the author's 15 years of experience with transportation systems operated by volunteers in Sonoma County, California.

12.5.2 Developing Terms of Reference

The terms of reference for a transportation study are a formal statement of the work to be undertaken. They should include:

- purpose and objectives of the study;
- listing of all the client groups for which the study is being undertaken and their needs;
- range of service options to be examined, e.g., transit services, taxi services, handivan and handibus services;
- data to be collected and analysed;
- institutions and agencies to be contacted;
- staff time to be supplied by the municipality;
- timing of the study;
- reporting requirements, e.g., frequency of meetings with the municipal project officer and/or the steering committee guiding the project;
- budget constraints and the contractual process;
- final products to be developed as a result of the study;
- data base available.

Whether a transportation study is carried out by municipal staff, volunteers, or consultants, it is important to develop terms of reference because they help to keep a study on track and within budget.

12.5.3 Role of a Steering Committee

Steering committees are particularly important when undertaking studies of accessibility for seniors and persons with disabilities because so many groups are interested in the outcome. For example, the stakeholders in a study for the Red Deer, Alberta, area included:

- service providers;
- advocates for seniors and their clientele;
- advocates for persons with disabilities and their clientele;

- municipal funding and support agencies;
- provincial regulatory and funding agencies.

Somewhat like a board of directors, a steering committee provides policy guidance and tries to balance the various interests in reaching a consensus. The tasks of a steering committee may include:

- developing the terms of reference;
- reviewing consultant proposals;
- reviewing work in progress;
- assisting in data collection;
- reviewing final study products or "deliverables" to ensure that the terms of reference have been met.

12.5.4 Selecting a Consultant

Most transportation studies in smaller communities involve one or more consultants, who may have experience gained from similar work in another area. Consultants are usually called in because smaller communities either do not have specialized expertise available on staff or do not have sufficient human resources to undertake new projects.

Outside consultants can bring a new dimension to the study process, and can assist in developing the terms of reference and in defining tasks. Consultants with broad geographic experience can transfer experience from many communities to the area of the study. They are often seen to be more objective when many disparate interests are involved.

Selection of a consultant involves:

- inviting proposals from consultants specializing in public transportation;
- reviewing and evaluating the proposals submitted;
- contracting with a consultant to carry out the study.

Requests for Proposals

Formal requests for proposals (RFPs) from consultants comprise a letter of invitation, along with the terms of reference and background data for the communities involved. In Alberta, the normal policy is to send an RFP to at least three consultants; sending RFPs to many consultants creates work for the reviewers and wastes consulting resources. Most consultants prefer the potential client to create a short list based on a brief submission of experience and qualifications first, and to send the RFP only to the consultants on the short list.

Evaluating Proposals

An effective evaluation process was used for the Red Deer Area Accessible Transportation Study (Atkinson, 1993). Separate methodology and price proposals were submitted, and each member of the steering committee was asked to evaluate the consultants' proposals using the form shown in Table 12.1. If two acceptable proposals scored equally high, the price proposals and other factors were used to break the tie. The Transportation Development Centre uses a similar process to select consultants.

Table 12.1 Consultant proposal evaluation: Red Deer area study

Consulting Firm: **Evaluator:**

Item	Rating		Weighting Factor	Weighted Rating
	Initial	Final		
1. Management			6	
2. Expertise			4	
3. Methodology			8	
4. Social Aspects			2	
5. Other				
			Total	

(Rating: 5 = Excellent, 1 = Poor)

COMMENTS

1. Management ______________________________

2. Expertise ______________________________

3. Methodology ______________________________

4. Social Aspects ______________________________

5. Other ______________________________

(City of Red Deer, Alberta)

Consultant Contract

The contract with the consultant can be a formal document, or simply a purchase order with the terms of reference and the consultant's proposal attached. Formats for formal contracts are available from sources such as the provincial associations of professional engineers.

12.5.5 Study Budgets

Transportation study budgets can be roughly estimated from the length of time required to complete the study. A major cost variable is the amount of public participation required. Municipalities can reduce the cost of outside consultants by:

- accurately defining the work to be undertaken;
- conducting focus groups and public meetings;
- carrying out surveys;
- collecting and analysing data.

A cost-effective practice is to have the consultant design the surveys, and then have municipal staff or volunteers collect and analyse data.

12.5.6 Data Collection and Timing

Studies involving extensive data collection are best carried out in the spring or the fall – ridership data are atypical and interviews are hard to arrange in summer and collecting data during severe winter months is not cost-effective. If ridership data are available, then late spring is a good time for transportation studies where a fall implementation target or input to the subsequent year's budget is required. Studies carried out in the fall may miss the municipal budget process, which often begins as early as August.

Data collection includes several tasks:

- making an inventory of existing services and needs;
- making an inventory of unsatisfied needs;
- collecting existing reports and documents, including maps;
- conducting consumer surveys;
- convening focus groups;
- interviewing stakeholders;
- conducting public meetings.

Inventory of Needs and Services

Accessible transportation studies begin by making an inventory of existing needs and services. The inventory can be developed by interviewing members of the steering committee; municipal staff; and representatives of advocate agencies, care agencies, and existing service providers. Quite often, the service providers – transit system, taxi, and special transit operators – are aware of many of the unsatisfied travel needs in the community.

Data collection is an essential part of the inventory of existing and unsatisfied needs. The inventory of services should include details on vehicle fleets, service provided, costs of operation, fares charged, and passenger ridership statistics.

Documents Required

It is important to acquire good base maps of the area under study at an early stage. Other documents that may be required include:

- previous reports on the subject
- demographic data
- taxi bylaws
- policy statements
- directories for advocate and care agencies

Consumer Surveys

The most commonly used surveys for accessible transportation studies include:

- attitude surveys
- ridership surveys
- activity surveys

Attitude surveys are used to determine how consumers feel about existing transportation services. They need to be carefully structured with the help of persons experienced in carrying out such surveys. The results of such a survey are shown in Table 12.2.

Ridership surveys are needed where the transit or special transit system does not have existing data. For example, a specialized survey may be needed where data are not available on the usage of passes, rider categories, and hourly or daily variations in demand.

Activity surveys may be used to analyse travel patterns, activity centres visited, and shopping preferences. In major transportation studies, such surveys are usually called “origin-destination” or OD surveys.

Table 12.2 Rider attitude survey of the Citizens' Action Bus

SCALE
1 Very dissatisfied, poor service
2 Somewhat dissatisfied, below expectations
3 Adequate, satisfactory service
4 More than satisfactory, good service, exceeds expectations
5 Very satisfactory, excellent service
6 Don't know; unable to comment

Survey Questions	**1**	**2**	**3**	**4**	**5**	**6**
Available office hours to book rides	1	10	17	10	12	6
Actual hours of operation of the Citizens' Action Bus	1	4	21	9	15	4
Suitability, quality, and equipment in the buses	0	2	15	8	25	6
Fee structure and fares charged for using the Citizens' Action Bus	0	1	6	11	28	8
Satisfaction with the staff and administration of the Citizens' Action Bus	0	2	2	10	34	7
Availability of information regarding operations of the Citizens' Action Bus	1	2	18	5	20	10
Satisfaction with having Red Deer Cab's special taxi as an additional service	1	8	10	9	16	12
Overall satisfaction with the operations of the Citizens' Action Bus	0	1	11	9	27	6

(Red Deer Action Group for the Physically Disabled)

Focus Groups

Focus groups are used to brainstorm issues or needs to develop a consensus. If carefully planned, focus groups can be used to generate solutions to a problem rather than more problems.

Personal Interviews

The interviews begun during the inventory of needs and services can continue throughout the study. They are very important, as they fill in missing pieces of data. Quite often, an interview will uncover another source of data, or an individual

or agency that has been overlooked. Personal interviews are important to place needs in perspective and to provide guidelines for the study.

Public Meetings

Public meetings can be used for different purposes before, during, and after the study. Meetings held before the study can help to define needs, and to structure the terms of reference. During the study, prospective customers can be asked to review alternatives and to articulate needs. After the study, public meetings serve to present the findings.

Municipal staff should organize the public meetings and, if necessary, attend to answer questions. Outside specialists can provide advice on formats and agendas. The meetings should be held in easily accessed public buildings. Accessible transportation systems can advertise their services for persons attending the meetings.

12.5.7 Summary of Needs and Opportunities

If school-bus and/or paratransit systems already exist, the opportunities can include:

- better coordination of services operated by different providers;
- transfer of ambulatory persons to lower-cost services;
- alleviation of capacity constraints;
- greater business volume to achieve economies of scale;
- methods of responding to new market opportunities.

The need for public transportation systems is related to community characteristics and demographics. For example, a very small community's primary need could be for some type of accessible taxi service. In larger communities with several local activity centres, a handivan or handibus service may be the best option. Where institutional facilities such as clinics and hospitals are located in a nearby community, accessible inter-community services may be required.

One agency or individual's transportation needs are another's opportunity. For example, the persons requiring accessible transportation provide market opportunities for private taxi and school-bus systems. In cities with accessible taxis, new markets have quickly developed.

Any transportation study should examine opportunities for stimulating a local response to the needs of seniors and those with disabilities. A new transportation service can often be established by providing some modest incentives and coordinating existing transportation resources.

12.5.8 Developing a Service Plan

In developing new transportation services, any existing transit systems must continue to be major carriers of seniors and persons with disabilities. Market segments that cannot be accommodated by making the transit system more accessible can be served by some form of paratransit system.

The integration of existing transportation services into the system needed in the future can occur in carefully controlled stages. The *Canadian Transit Guide* provides methods of estimating the demand for new paratransit services based on the characteristics of a community (CUTA, 1993). The market can be tested for each increment of service, and if the expected response is not forthcoming, that service can be postponed until future demand warrants it.

Experience with more than 400 accessible transit services in Canada has shown that a family-of-services approach is the most cost-effective way of responding to the needs of seniors and persons with disabilities. Options presented in this chapter can become components of the various methods used to satisfy transportation needs.

12.6 Overall Planning Guidelines

Table 12.3 provides typical transit services for a range of community populations. Table 12.4 illustrates typical costs for various service-delivery methods.

Table 12.3 Typical transit services in small urban and rural communities

Development Stages	Service Area Population			
	Up to 2,500	2,500 to 5,000	5,000 to 7,500	7,500 to 10,000
1. Substantial use of volunteers driving personal vehicles	X	X		
2. Operation of accessible van or bus by service club		X	X	X
3. Potential for accessible taxi service		X	X	X
4. Potential for multi-purpose paratransit system			X	X
5. Potential for multi-purpose fixed-route transit service				X

(MANOP Services Ltd.)

Table 12.4 Typical system costs in small urban and rural communities (1996 dollars)

Volunteers driving private vehicles • Usually paid for their kilometres of travel • Rate varies depending upon trip lengths
Accessible van or bus • Capital costs for two vans: $120,000 • Annual operating costs: $50,000 to $100,000 • Typical deficits: 75% to 85% of operating cost
Accessible taxi service • Capital cost per vehicle: $35,000 to $50,000 • Typical flat rates: $5.00 to $10.00 per one-way trip • Typical operating subsidies: $2.00 to $3.00 per trip
Paratransit service • Capital cost for a three-vehicle fleet: $180,000 • Annual operating costs: $100,000 to $200,000 • Typical deficits: 60% to 80%
Fixed-route transit • Capital cost for a three-bus fleet: $400,000 • Annual operating costs: $200,000 to $300,000 • Typical deficits: 40% to 60%

(MANOP Services Ltd.)

Service planners of rural transit and paratransit systems should consult the following:

- Section 3.3 for pedestrian access, Section 3.4 for terminal requirements;
- Section 5.2 for communications media and technology;
- Sections 7.3, 7.4, and 7.5 for staff training programs;
- Section 9.4 for the role of taxis;
- Section 10.3 for urban bus transit and paratransit systems;
- Section 17.2 for multimodal travel;
- Existing manuals and guidelines named in the References;
- Communities with established transit services;
- Local charitable foundations and service clubs that regularly assist small communities and rural areas to obtain vehicles and/or operating assistance;
- Regulations and guidelines provided by provincial funding agencies;

- The Canadian Urban Transit Association (CUTA);
- The provincial equivalents of CUTA, e.g., the Ontario Urban Transit Association.

The steering committee for a study in Alberta adopted the following strategic planning guidelines:

- The regional transportation plan shall be consistent with the province-wide goal of barrier-free transportation systems and pedestrian infrastructure by the year 2000 (Alberta, 1995b).
- The goal shall be to provide a family of accessible services as alternatives to travel by private means.
- The quality of service shall be consistent with shared-ride transit systems and services (i.e., service quality is not intended to match travel by private automobiles or exclusive ride systems and services).
- The initiative for obtaining funding for capital assets should rest with each community and/or municipal jurisdiction, consistent with its local needs.
- The operating costs of any services that cross municipal boundaries must be equitably apportioned between sponsoring agencies, according to their community needs.
- The service-delivery organization should be patterned after existing and successful community models used, for example, to manage parks development, heritage projects, social-planning activities, and transportation services.
- The plan should provide for the participation of volunteer agencies and public and private enterprise.
- The plan must allow room for flexibility in its development and for future contributions from interested advocates and agencies (i.e., the transportation plan should not be developed in its entirety in year one).
- The standards of conduct required from all transportation-system riders shall be the same. These standards shall be communicated to all riders.
- If required, the provision of escorts and attendants shall be the responsibility of the individual rider or guardian.
- Sensitivity training for drivers and riders shall be included in the plan.
- Inter-municipal cooperation and coordination of assets should support mutual aid plans.

- 13 -

AIR TRANSPORT SYSTEMS

– 1 – INTRODUCTION

CUSTOMER ACCESS

– 2 – TRIP PLANNING	– 3 – ROADWAYS & TERMINALS	– 4 – PERSONAL VEHICLES

SYSTEM ACCESSIBILITY

– 5 – COMMUNICATIONS SYSTEMS	– 6 – SAFETY & RELIABILITY	– 7 – TRAINING	– 8 – RESEARCH & DEVELOPMENT

PUBLIC CARRIERS: LOCAL

– 9 – ACCESSIBLE TAXIS	– 10 – URBAN BUS SYSTEMS	– 11 – URBAN RAIL SYSTEMS	– 12 – RURAL SYSTEMS

PUBLIC CARRIERS: INTERCITY

– 13 – AIR TRANSPORT SYSTEMS	– 14 – INTERCITY RAIL SYSTEMS	– 15 – INTERCITY BUS SYSTEMS	– 16 – MARINE SYSTEMS

– 17 – MODAL INTEGRATION

Related Information: Planning guidelines common to all transportation systems are discussed in Chapters 2 through 8.

13 Air Transport Systems

Canadian air carriers provide domestic travel, trips to the United States, and overseas travel. The carriers are subject to Canadian and international standards of safety and accessibility. In Canada, aircraft provide approximately 34 percent of long-distance trips made by persons with disabilities using public carriers.

Unlike the intercity bus and rail transportation industries, the airlines generally do not own their terminal facilities; rather, they lease space from a central airport authority. Originally controlled by Transport Canada, most airports are being transferred to private local authorities who must weigh all interests when making investments in new facilities.

During the past decade, considerable progress has been made in improving accessibility to air travel for travellers with disabilities. In North America, the development of technology is such that air transportation by larger aircraft from airports equipped with loading bridges is already largely accessible. However, the airline infrastructure has evolved into a hub-and-spoke operation, with regional carriers operating smaller aircraft to provide feeder services. Consequently, accessibility of these commuter aircraft to persons with disabilities has become a prime concern. Both Canada and the United States are addressing issues concerning such aircraft, as well as larger aircraft at airports with neither loading bridges nor specialized boarding systems (Nishizaki, 1992).

Projections of the 1991 Health and Activity Limitation Survey (HALS) data to the year 1995 result in an estimated 715,000 persons with disabilities who would travel by air (Goss Gilroy Inc., 1995c). This segment of the long-distance travel market is characterized as follows:

- These travellers represent 18.8 percent of the 3.8 million adult Canadians with disabilities.
- They are more likely to have disabilities that affect mobility, agility, and/or hearing. They are less likely to have very severe disabilities.
- Compared to the average person with a disability, their individual employment income was greater in 1991, with 36.1 percent earning over $25,000 annually.
- Almost 650,000 persons (90.9 percent) in this group travel without difficulty.
- Approximately 65,000 persons (9.1 percent) encounter difficulties with aggravation of their condition due to the flight; transporting their mobility aids; moving around the terminal; enplaning/deplaning; or the seating on board. About 26,000 of these travellers must limit their air travel.
- Approximately 115,000 (16.1 percent) of air travellers reported difficulties in obtaining information on services and facilities.
- Due to their condition or disability, approximately 75,000 (10.5 percent) require an attendant or companion to accompany them on long-distance trips and 27,000 require specialized transportation services or facilities.

- During the three-month period between April 1 and June 30, 1995, an estimated 307,000 persons with disabilities took long-distance trips by air, representing 614,000 one-way trips. The Canadian Transportation Agency estimates that approximately 700,000 round trips by air are made annually by persons with disabilities (CTA, 1996b).

13.1 Accessibility Issues

Air transportation's many unique features and technologies can present special challenges to travellers with disabilities. The accessibility of the 200 or so land airports varies greatly. In addition, the aircraft used by the airlines have varying degrees of accessibility, depending on their type, size, and year of manufacture.

From the customer's point of view, each link or component of a trip by aircraft must be accessible. This includes the feeder buses and taxis that serve an air terminal, the parking or drop-off areas, the entrance to the terminal, the ticket counters, the washrooms, the restaurants, and the enplaning areas. The major accessibility issues related to customer needs are:

- customer communications;
- access to terminals;
- accessibility within terminals;
- access to aircraft;
- access within the aircraft cabin;
- provision of space for service animals and stowage of mobility devices.

13.1.1 Customer Communications

One of the important features of air travel is that customers are identified individually, thus allowing the carrier to encode special needs in a reservations file. Since seats for passengers who use wheelchairs are limited, they are assigned during the reservation process. The challenge is to ensure that all persons with disabilities are able to use the communications systems that provide flight information and receive reservations. Chapter 2 discusses the trip-planning process, and Chapter 5 describes the technologies used to facilitate customer communications.

13.1.2 Access to Terminals

Unlike rail and bus terminals, the larger air terminals usually have several entrances, which may be at different levels. Most airports also have a hierarchy of

access by feeder mode, with taxis and shuttle buses providing doorstep services, while other modes are placed farther away from the terminals. The usual arrangement requires a traveller who has parked in the long-term area to walk through the bus parking, the rental cars, and the short-term parking area before arriving at the departures level entrance. Larger airports operate shuttle buses between remote parking areas and terminals, but some of these buses are not accessible (Hare, 1992). Montreal's Dorval Airport provides valet parking.

The several layers of the feeder system and the parking assignment increase the need for signs, accessible pathways, and public address systems. They may also need considerable maintenance in inclement weather. Chapter 3 discusses parking and pathways, and Chapter 5 deals with signs.

13.1.3 Accessibility inside Terminals

Most air terminals are accessible to independent travellers with adequate physical strength. Persons who tire easily, however, find that the distances from parking lot or entrance to check-in, security clearance, and departure gates can be a significant challenge. Using the washrooms, restaurants, and other terminal facilities expends additional energy.

Ease of movement inside a terminal depends on adequate wayfinding systems and successful communications with airline and terminal personnel. Disabled passengers may require assistance with baggage handling and level changes. Arrangements made during the flight-reservation process must be confirmed with the agent at the time of check-in.

Specific needs inside the terminal include:

- directional assistance to ticket counters, baggage check-in, departure gates, and terminal facilities;
- special technology for non-verbal communications;
- special seating;
- communications devices for travellers with disabilities related to speech or hearing;
- access to washrooms, food services, and shopping;
- special handling of personal mobility equipment, such as wheelchairs;
- access to the boarding ramp (up or down stairs, elevators, or escalators; through doors);
- directions to the correct boarding ramp (signs, verbal instructions, audio instructions);
- availability of specialized equipment to board (lifts, wheelchairs, and transfer equipment);
- assured transport of personal equipment given up at the boarding point;

- special identification of baggage for passengers who are blind or have poor vision;
- information displays for passengers with hearing disabilities.

13.1.4 Access to Aircraft

Access to the aircraft itself may present the greatest challenge, depending on the type of aircraft used and the facilities available at the air terminal. In the past, confusion has resulted from the varying practices used to stow travellers' personal mobility aids. This has been clarified in new federal regulations (see Section 13.2). Technology is also being developed to accommodate the low-level boarding requirements of small aircraft (see Section 13.4).

13.1.5 Accessibility within Aircraft

The major needs inside the aircraft include:

- movement to the assigned seat;
- fastening the seat belt;
- storing belongings in stowage compartments;
- seat adjustment;
- seat table adjustment;
- management of overhead controls (light, air conditioning, call button for assistance, safety oxygen mask);
- explanation of evacuation procedure and movement in an emergency;
- easy-to-manage food and drink;
- access to washroom entrances;
- accessibility inside washrooms.

13.1.6 Provision for Service Animals

Air carriers currently provide for transporting certified service animals as specified in the Canadian Transportation Agency (CTA) regulations. Service animals include dogs or monkeys that perform tasks, signal dogs that alert individuals with hearing disabilities, and social dogs that provide affection for persons with disabilities. If the definition of service animal is expanded to cover other social animals (animal companions that provide feelings of well-being) such as cats and monkeys, a whole new set of issues may arise. Problems could arise due to conflicts between

persons with different types of disabilities. For example, an asthmatic person may not be able to sit near a service animal. Large dogs often cannot fit under a seat because of the brackets, foot rests, and bars that prevent baggage from sliding. On wide-body aircraft, the bulkhead seat is preferred because the dog can lie parallel to the row (Rutenberg and Geehan, 1994b).

13.1.7 Information and Communication

For passengers with severe disabilities affecting sight, hearing, or speech, information and communication are the most important issues. Individual safety briefings are therefore specified in Canadian Transportation Agency regulations for passengers with disabilities (MacDonald, 1995).

Blind passengers often find inconsistencies in the briefings about the location of facilities in the aircraft (seat row, toilets, emergency doors) and the emergency or evacuation procedures.

13.2 Regulation

Civil aviation in Canada is administered by the federal government by authority of the Aeronautics Act and the Canada Transportation Act, 1996. The Aeronautics Act deals with matters related to aircraft registration, licensing of personnel, establishment and maintenance of facilities for air navigation and air-traffic control, and safe operation of aircraft. It is administered by Transport Canada Aviation. Transport Canada has established the Canadian Aviation Regulation Advisory Council (CARAC) to review all Transport Canada regulations. Representatives of the community of persons with disabilities participate in this process.

The Canada Transportation Act deals with the economic aspects of commercial air services and assigns economic regulatory functions to the Canadian Transportation Agency (CTA) regarding commercial air services. The CTA has the power to enforce the removal of undue obstacles from Canada's federally regulated transportation network (air, rail, marine). The removal of obstacles means that persons with disabilities should not be restricted by unnecessary or unjustified barriers to travel.

As of 1996, the CTA introduced two new sets of regulations: an amendment to the Air Transportation Regulations – Part VII, Terms and Conditions of Carriage of Persons with Disabilities; and the Personnel Training for the Assistance of Persons with Disabilities Regulations. The Agency has also developed a Code of Practice for aircraft accessibility. For more information, contact:

Accessible Transportation Directorate
Canadian Transportation Agency
Ottawa, Ontario K1A 0N9
Telephone: 1-800-883-1818 or (819) 997-6828
TTY/TDD: 1-800-669-5575 or (819) 953-9705

13.2.1 Accessibility Regulations

The following is a general description of the principal provisions of the Air Travel Accessibility Regulations (CTA,1996a).

Services to be provided

Air carriers must provide services to persons with disabilities when a request is made at least 48 hours prior to departure, and a reasonable effort must be made to accommodate requests not made within this time limit. These services include assisting with registration at the check-in counter, proceeding to the boarding area, enplaning and deplaning, stowing and retrieving baggage, moving to and from the aircraft's washroom, and proceeding to the general public area, or, in some cases, to a representative of another air carrier. Carriers are also responsible for transferring travellers who use mobility aids from their own aids to ones provided by the carrier for boarding, and from the boarding aids to their aircraft seat. They must also provide limited assistance with meals, and enquire periodically during a flight about a person's needs.

Certain terms and conditions of carriage do not require any advance notice. For example, if requested to do so at the time of reservation, air carriers must describe the services that they provide to persons with disabilities. Carriers must also furnish a written confirmation of the services requested. Where possible, accessible seats should be the last seats assigned to passengers without disabilities.

Carrying mobility aids

In most cases, air carriers must carry mobility aids and other devices free of charge as priority baggage. Carriers are also required to allow the use of manually operated wheelchairs up to the departure gate (and, in certain circumstances, to the person's seat on board the aircraft) and to allow the carriage, where space permits, of manually operated folding wheelchairs and small aids in the passenger cabin. Where mobility aids cannot be carried in the passenger cabin, carriers must disassemble them for carriage and promptly reassemble and return them at the person's destination.

When a mobility aid is damaged during carriage or is not available at the person's destination, carriers must provide a suitable temporary replacement without charge. Carriers are also responsible for repairing a damaged mobility aid or, if an aid cannot be repaired or is lost, for either replacing the aid or reimbursing the person for the full replacement cost of the aid.

Service animals

Air carriers must accept service animals free of charge, provided the animal is properly harnessed and certified as having been trained by a professional service-animal institution. On board, the animal is permitted to remain on the floor at the person's seat.

Self determination

Air carriers must accept the determination made by or on behalf of a person with a disability that the person does not require any services during a flight other than those required by the amendment to the Air Transportation Regulations.

13.2.2 Training Regulations

The following summary outlines the CTA Personnel Training for the Assistance of Persons with Disabilities Regulations (CTA,1996a).

Rail, marine, and air carriers (except small air carriers) as well as rail, marine, and air-terminal operators (except small air-terminal operators) are required to ensure that their employees and their contractors who provide transportation-related services to disabled persons are properly trained to do so.

Employees and contractors who interact with the public or make decisions about transporting disabled persons must know their employers' policies and procedures for persons with disabilities. In addition, they must receive general sensitivity training so that they can identify and respond to the needs of travellers with disabilities.

Carrier employees and contractors who provide physical assistance to persons with disabilities must be trained to transfer a person to a wheelchair properly, to guide and orient a blind or visually impaired person, and to assist a person who has balance, agility, or coordination difficulties.

Carriers must also ensure that their employees and contractors are trained to handle different types of mobility aids. The regulations require them to be familiar with the procedures for securing, carrying, and stowing mobility aids, including methods of disassembling, packaging, unpackaging, and assembling these aids.

Training is required for carrier employees and contractors who assist with special equipment or aids provided by the carriers for persons with disabilities: telephone devices, audio or video equipment, level-change devices, and on-board oxygen.

Personnel must complete their initial training within 60 days of beginning work. They also must receive periodic refresher courses. Carriers and terminal operators must keep a copy of their training program available for reference by the general public.

13.3 Accommodating Customers with Disabilities

The following summarizes the typical 1995 practices and procedures used by major Canadian air carriers to accommodate their customers with disabilities. These practices must comply with CTA regulations as they are issued and/or amended. They are presented here for planners and designers because they affect terminal and system facilities.

13.3.1 Within the Terminal

Most large Canadian airports have low-level service counters for travellers with special needs. These are identified by a large wheelchair sign (see Figure 13.1). At these counters, passengers are checked in, and their mobility equipment and any special needs or requirements are marked on their ticket.

Figure 13.1 Example of a special service counter
(Rutenberg Design Inc.)

Airline ground personnel are responsible for arranging any special assistance required. For example, a passenger who is blind will be accompanied to the waiting lounge by a carrier agent.

In large terminals, a passenger in a manual wheelchair may be pushed by a carrier agent from the check-in to the departure lounge or transported by electric vehicles (purpose-built transporters, modified golf carts) to the waiting lounge (see Figure 13.2). Passengers who use powered chairs are usually immediately transferred to an airline wheelchair.

Figure 13.2 Example of a wheelchair transfer vehicle used in air terminals (Tescar)
(Rutenberg Design Inc.)

Low-floor terminal transfer vehicles have been developed to transport several passengers with limited mobility, along with their baggage. These vehicles, which can traverse sloped loading bridges to the aircraft door, reduce the numbers of carrier personnel needed to assist passengers with disabilities.

At the final destination, a passenger's manual wheelchair (with a special handling tag) is carried by baggage handlers from the cargo hold to the transfer point (aircraft seat, bridge, or counter) and unfolded or assembled. The passenger is lifted or helped into the wheelchair. A problem could arise on a trip involving many transfers when the passenger's own wheelchair does not arrive at the destination. Although the carrier will provide a wheelchair without charge, many passengers

have special seats, cushions, back supports, and other accessories required for their comfort and mobility.

It may be time-consuming, costly, even impossible in the short term to replace these items, which may be ergonomically designed to fit the wheelchair user (Rutenberg and Geehan, 1994a). Because of this potential problem, carriers may encourage travellers to bring these items on board.

A substantial amount of special airport communications technology has been developed (Rutenberg, 1994b). One item is *Communicaid*, an electronic passenger information terminal that is accessible to passengers with hearing, speech, or vision disabilities, as well as to the general public (see Figure 5.2). The information is delivered in English and French, and in visual, audio, and symbol modes (see Section 5.2.2).

Another communications system is the multilingual translation terminal *Translaid*, which facilitates communication between an agent and a passenger who has a speech or hearing disability, or speaks a different language (see Section 8.8.4). The design of transportation terminals is discussed in Section 3.3.

13.3.2 Within the Cabin

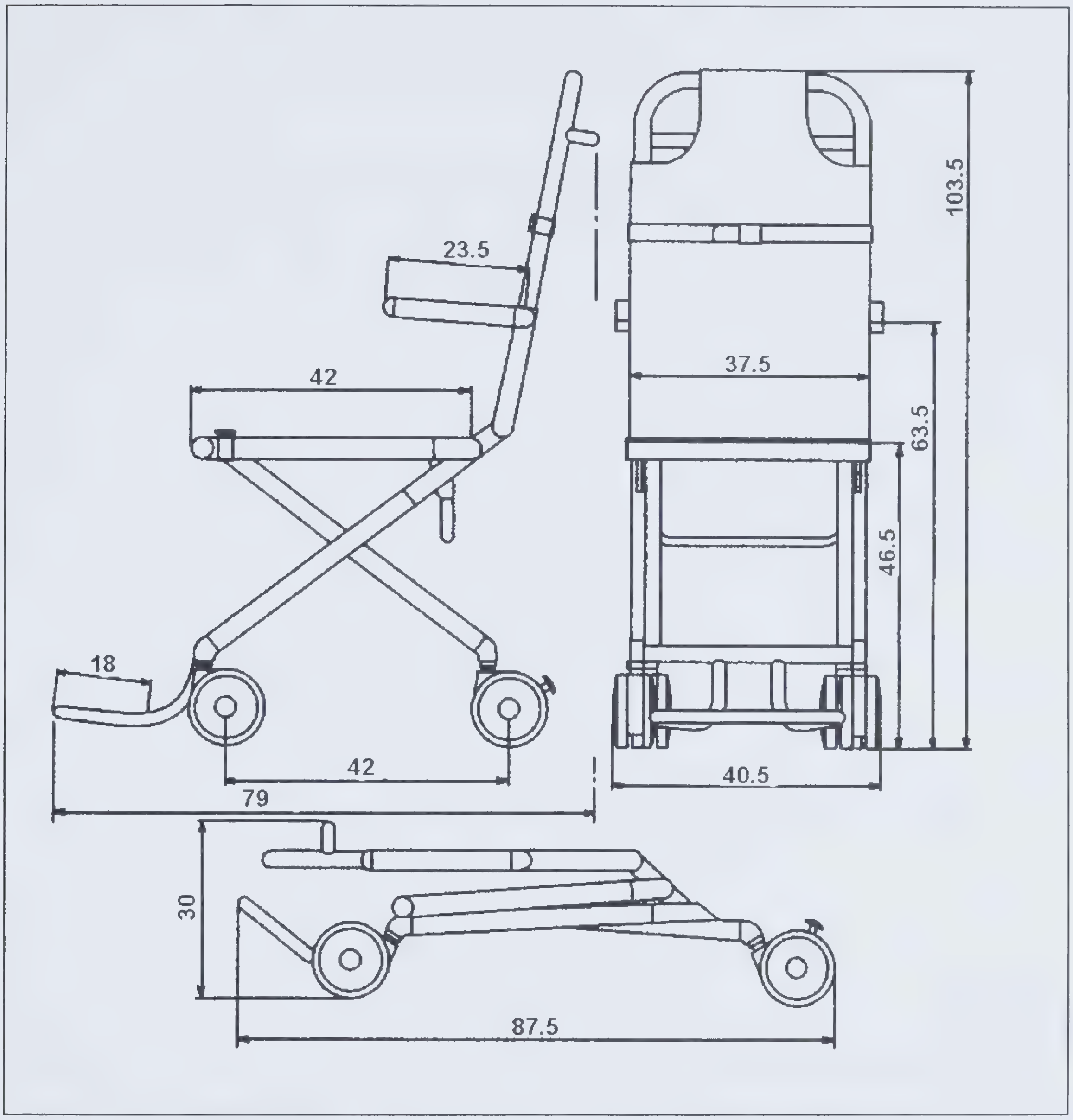
Under the air carriers' airworthiness regulations, passengers who use wheelchairs are not allowed to remain in these chairs in the aircraft.

Several methods can be used to transfer passengers from their wheelchairs to an aircraft seat. One is to transfer them to an airline wheelchair at the check-in counter, and transfer them again at the entrance to the aircraft. Another is to make the first transfer at the entrance to the aircraft. A third is for passengers to remain in their own wheelchairs, enter the aircraft, and transfer directly to their seats; this is only possible when a passenger has a seat adjacent to the entrance or when the aircraft has a sufficiently wide aisle (e.g., a B-767). In most cases, airline personnel must transfer wheelchair passengers manually to an aircraft seat.

Usually the passenger's wheelchair is folded or taken apart, put into a protective container, and transported to the cargo hold. Where space permits, one manual, foldable wheelchair can sometimes be transported on board the aircraft.

In-Cabin Facilities on Large, Wide-Body Aircraft

All large aircraft are equipped with accessible washrooms for persons who use onboard wheelchairs. Canadian carriers use special on-board wheelchairs (see Figure 13.3). Several models are in use, since standardization has not been achieved. Most are foldable, and are stored in a cabin closet (Barkow and Vautour, 1993).



(Dimensions in cm)

Figure 13.3 Example of an on-board folding wheelchair
(Interior Mediquip Ltd.)

In-Cabin Facilities on Medium-Sized and Small Aircraft

The washrooms on medium-sized aircraft may be accessible to a person using an on-board wheelchair. They are usually located both fore and aft, and can only be reached via the aisle. On aircraft where the bulkhead seats offer additional floor space, customers with mobility disabilities may be assigned to these seats. (Bulkhead seats are often also assigned to families travelling with children.) On

some aircraft, namely the Canadair CLRJ-65 and the Douglas DC-9, the bulkhead row does not offer more leg-room than any other row in the economy-class cabin. This is not an issue, as most aircraft seats are fitted with liftable armrests to allow for safe and dignified transfers.

Small aircraft with fewer than 30 seats usually do not have washrooms, and their aisles are narrow. Very few small aircraft have an on-board cabin wheelchair. (The narrowest available wheelchair requires a minimum aisle width of 33 cm.) Examples of wheelchair widths and small-aircraft aisle widths are shown in Table 13.1.

In small aircraft, the seating of passengers with disabilities is a critical issue. If such passengers could be seated in a first-row seat (often referred to as exit-row seating), the problem of getting down a narrow aisle would be solved. After much controversy, it was determined in the United States that front-row seats divided by an aisle, or bulkhead seats which do not prevent access to an exit doorway, can be occupied by any passenger. This issue of seat assignment has not been resolved in Canada (Rutenberg, 1994b).

Table 13.1 Examples of manual wheelchairs that fit small aircraft

	Aircraft (aisle width in cm)				
Boarding Chair (width)	Dash-8 38.1	CV-580 45.7	 41.9	Jet stream 38.1	Metro III 35.6
Amigo Escort (45.7 cm without arms)					
Travel Mate (43.8 cm)					
Brockway Air Prototype (27.9 cm)	Yes	Yes	Yes	Yes	Yes
Airline Transfer Chair (54.6 cm)					
I. Dee M. Chair (40.6 cm)		Yes			
Vogel Seat (40.6 cm)		Yes			
Washington Chair (38.1 cm)		Yes	Yes		

(Guthrie, 1988)

Safety requirements are open to interpretation by the carriers when assigning seats. Given existing rules, procedures, and interpretations, it is safe to assume that passengers with disabilities will usually have to negotiate the narrow aisles of small aircraft.

In the United States, the Air Carriers Act states that new aircraft with more than one aisle, ordered after April 1990, must have at least one accessible washroom. Aircraft with more than 60 seats and an accessible washroom must be equipped with an on-board wheelchair. Aircraft in service in April 1990 had to be retrofitted when they underwent major interior changes.

13.4 Boarding Systems

13.4.1 Large and Medium-Sized Aircraft

Boarding systems for large aircraft at large airports in Canada consist of either covered loading bridges or Passenger Transfer Modules (PTM), which pick up passengers at the terminal, deliver them to the aircraft, and lift the PTM cabin to the aircraft door (see Figure 13.4). Smaller airports without loading bridges use movable stair units for most passengers.

The Canadian General Standards Board (CGSB) has developed a new standard for portable lift equipment (CGSB, 1995). Some airports use a self-propelled platform lift for access to medium-sized and smaller aircraft (see Figure 13.5).

13.4.2 Small Aircraft

Small aircraft usually have fewer than 60 seats; the entrance door is narrow (about 63.5 cm), and five to eight steps must be negotiated from the tarmac to the aircraft cabin door. Often they are not docked at loading bridges. (TDC is investigating a new low-level bridge.)

The Dash 8, Twin Otter, Cessna 402, Jetstream 31, Metro II, and CV-580 are examples of small aircraft.

Several level-change devices are in use:

- powered stair climbers;
- combined stairway and powered-lift platform (e.g., Brownie Tank Stairlift);
- forklift with pallet;
- self-propelled unit with vertical lift platform, e.g., Wollard PAL651 (Ostry, 1992).

When boarding a small aircraft without a loading bridge, the passenger may be transferred to an airline chair (the usual practice) or remain in his or her own wheelchair until transported and lifted by special equipment to the entrance of the

aircraft (see Figure 13.6). The transfer from the chair takes place in the doorway. The passenger's wheelchair is removed from the aircraft, folded or taken apart, put into a protective container (electric batteries are placed in a different container), and stored in the cargo hold. When no equipment is available, the passenger and boarding wheelchair are lifted into the aircraft together by carrier agents.

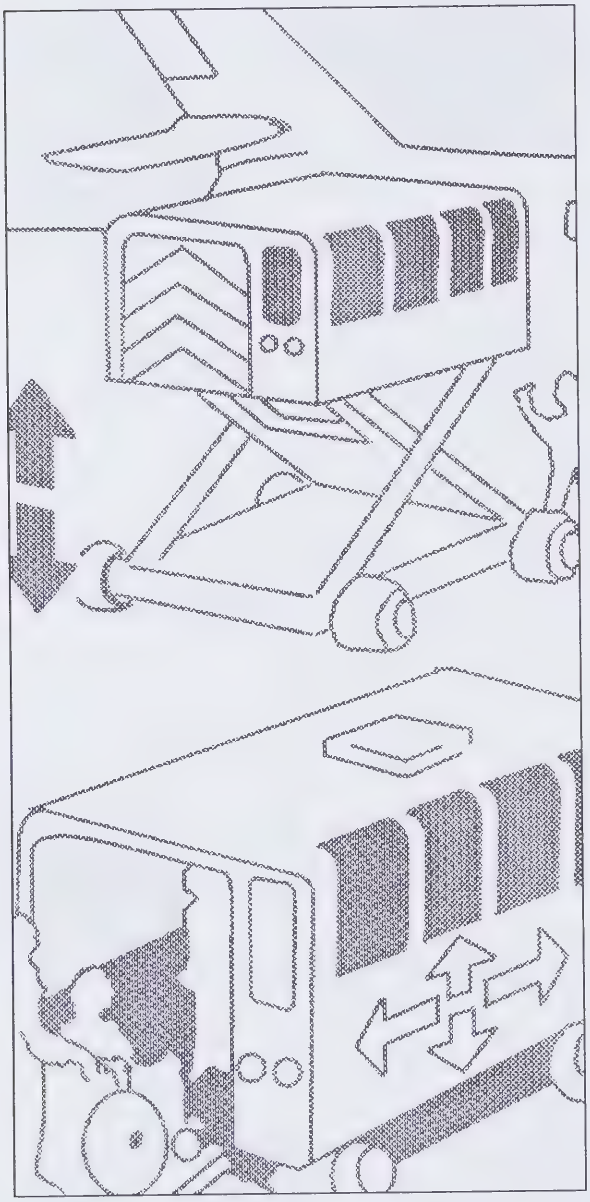


Figure 13.4
Passenger transfer module (PTM)
(Rutenberg Design Inc.)

Figure 13.5 **Mobile boarding system for medium-sized aircraft**
(Northwestern Motor Company Inc.; Air Canada)

Figure 13.6 **Manual boarding system for small aircraft (Mobilift model AX)**
(Adaptive Engineering Ltd.)

13.5 Guidelines for Planners and Designers

Table 13.2 provides a summary of recommended infrastructure and customer-service improvements.

For more detailed planning and design information on accessible air services, consult:

- Section 3.5 for human factors in design;
- Section 5.2 for communications media and technology;
- Sections 6.3.3 and 6.4.2 for safety requirements;
- Section 7.6 for staff training programs;
- Section 8.8 for current research and development projects;
- Section 17.2 for multimodal travel requirements;
- Canadian Standards Association CAN/CSA-B651-95 on *Barrier-Free Design*;
- Carriers that have developed specialized accessibility technology, including airlines, VIA Rail, the Greyhound Group of Companies, and the large transit and paratransit systems in major cities.

Table 13.2 Recommended infrastructure and customer-service improvements

Infrastructure Recommendations
Provide
• electronic flight destination signs at departure gates
• flashing lights and signs over departure gates indicating that boarding has begun
• loop-activated information systems at the departure gates for passengers with impaired vision or hearing
• consecutive row numbers from the front to the back of the aircraft, without omitting any numbers
• a tactile seat-coding system that uses raised characters on the top edge of armrests on aisle seats
• colour-contrasted storage locations for easy identification by persons with limited vision
• seat-control mechanisms, with a distinctive texture, located on the inside of the armrest
• locations of washrooms in the safety video
Improve
• signs providing directions to boarding locations
• on-board lighting levels near seat-coding signs
• on-board signs indicating that seat belts must be worn and that smoking is not permitted
• signs indicating washroom doors and emergency exits

Table 13.2 Recommended infrastructure and customer-service improvements *(cont'd)*

Redesign

- call buttons to be at least 2.5 cm across and easy to distinguish, by touch, from the armrests
- the symbol on the call buttons to a "?"
- call buttons to prevent accidental activation
- seat-coding signs to be within the normal field of vision of most passengers (e.g., on seat backs)

Customer-Service Recommendations

Provide

- more emphasis on the availability of pre-boarding
- closed- or open-captioning on signs for persons who are deaf
- pre-boarding briefings that indicate washroom and emergency exit locations. Give the number of seat rows to the washroom when briefing a passenger with a visual disability
- a tactile map of the aircraft containing a layout of the interior, upon request
- information at a pace suitable to the capabilities of travellers with learning disabilities. A passenger-controlled information video system would be useful
- information about telephone usage and the availability of in-flight shopping on videos
- a personal demonstration of safety procedures to passengers with disabilities who are pre-boarded

Improve

- public address announcements so that they are clear and concise
- sensitivity training for flight attendants, with respect to persons with learning or cognitive disabilities

Redesign

- the safety card, safety video, and manual safety demonstration

Consider

- suggesting more convenient places for those with visual limitations to store their carry-on luggage

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INTERCITY RAIL SYSTEMS

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PUBLIC CARRIERS: INTERCITY

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Related Information: Planning guidelines common to all transportation systems are discussed in Chapters 2 through 8.

14 Intercity Rail Systems

This chapter discusses the accessibility of Canada's intercity passenger rail systems and offers guidelines for the future. Commuter rail systems have been included with the long-distance intercity systems because they use similar rail technology and infrastructure. This is consistent with Statistics Canada's aggregation of data for rail systems. Urban rail transit systems are discussed in Chapter 11. Other modes of travel that may function as feeder services to passenger rail systems, including buses and taxis, are discussed in their respective chapters.

Intercity and commuter passenger rail systems show great potential for serving the needs of new customers with disabilities. A notable example of this is the Government of Ontario Transit commuter rail system, which can now accommodate passengers who use wheelchairs (GO Transit, 1995).

The following rail systems are discussed in this chapter:

- VIA Rail Canada Inc.;
- GO Transit commuter rail services;
- STCUM (Société de transport de la communauté urbaine de Montréal) commuter rail operations in the Montreal Urban Community;
- West Coast Express in the Vancouver region.

Projections of the 1991 Health and Activity Limitation Survey (HALS) data to the year 1995 result in an estimated 168,000 persons with disabilities who would be travelling by intercity passenger rail systems (Turnbull and McKenzie, 1995). This segment of the long-distance travel market has the following characteristics:

- These travellers represent 4.4 percent of the 3.8 million Canadians with disabilities.
- They are more likely to have mobility, agility, hearing, and/or other disabilities. They are likely to have mild or moderate levels of disability, since those with severe disabilities may not be able to travel by rail.
- They have relatively modest levels of individual annual employment income; 26.9 percent had incomes over $25,000 in 1991, compared to 36.1 percent of those who travel by air.
- Of the 168,000 persons who travel by rail, 92.9 percent travel without difficulty.
- Approximately 12,000 (7.1 percent) encounter difficulties: aggravation of the individual's condition; transporting mobility aids; moving around the terminal; boarding/deboarding; and seating on board. Of these, 8,000 persons must limit their travel by rail.
- Approximately 26,000 (15.6 percent) reported difficulties in obtaining information on services and facilities.
- Because of their condition or health, approximately 29,000 (16.9 percent) required an attendant or companion to accompany them on long-distance trips.

- During the three-month period between April 1 and June 30, 1995, an estimated 68,000 persons with disabilities took long-distance trips by rail, for a total of 143,000 one-way long-distance trips.

14.1 Accessibility Issues

Passenger rail systems face a major challenge to improving their accessibility because of the history of their design and development. For example, in 1995, VIA Rail served more than 500 communities across Canada; at most stations, access from the platform to the high-floor passenger railcars requires a substantial level change.

Only two passenger rail terminals in Canada have high-level platform access: Montreal's Gare Centrale and Quebec City's Gare du Palais. The use of parallel rail lines to sort trains by direction and destination usually requires passengers to make two or more level changes to access the railcars. With the exception of the larger cities in Canada, most rail terminals have very few passenger amenities.

These accessibility challenges provided the initiative for a substantial amount of research and the development of station- and train-based lifts and accessible platforms. For example, the GO Transit commuter rail system has developed a system of ramps and platforms that accommodate a train-based folding bridge for wheelchairs, and VIA Rail has developed station-based lift systems for higher-volume rail terminals. These are portable lifts similar to those used by regional air carriers at lower-volume air terminals. VIA Rail also undertook research and development work on train-based lifts, but the results proved unacceptable (MacDonald, 1996).

The following design issues must be addressed:

- railcar floor height (station platform to older railcar floor level involves three steep steps);
- door clearance (some older railcars are not wide enough for wheelchairs);
- door clearance from vestibule to railcar interior;
- aisle widths;
- lift/hoist technology;
- accessible washrooms (currently they are only on designated railcars);
- space for wheelchair passengers;
- wheelchair securement;
- accessible seats (extra wide, pivoting armrests);
- information and communication systems.

Each component, as well as the sum of all components, must be accessible. The customer should be able to arrive at an accessible drop-off area or parking lot, follow an accessible path to the terminal, access counters and level changes in the

terminal, gain access to the boarding platform, move from the platform to the railcar, and move about in the railcar and the washroom. Table 14.1 presents a summary of the tasks that present a challenge to travellers on intercity rail systems (Arnold, 1993).

Table 14.1 Challenging tasks on board accessible intercity railcars

Tasks	Customer Disability				
	Mobility	Vision	Hearing	Learning	None
Boarding	X	X	X	X	
Moving within	X	X		X	
Moving between railcars	X	X			
Stowing articles	X	X			
Sitting		X		X	
Communicating with attendant		X	X	X	
Obtaining information	X	X	X	X	X
Food services		X	X	X	
Using washroom	X	X	X	X	X
Deboarding	X	X	X	X	X
Emergency procedures	X	X	X	X	X

(Arnold, 1993)

14.2 Regulation

14.2.1 VIA Rail Canada Inc.

Until 1996, VIA Rail was regulated by the federal Railway Safety Act, 1989, and the National Transportation Act, 1987. Under the National Transportation Act, 1987 (amended in July 1988), the National Transportation Agency (NTA) was given authority to eliminate obstacles from Canada's federally regulated transportation network, which includes the VIA Rail system and terminal facilities. The Railway Safety Directorate of Transport Canada has developed regulations and standards that govern safety. On July 1, 1996, the government promulgated the Canada Transportation Act, 1996. Pursuant to this Act:

- The NTA will continue as the Canadian Transportation Agency (CTA), with the same regulatory powers.
- The Railway Act will be consolidated with the Canada Transportation Act.
- Other relevant Acts will be amended or repealed.

Accessibility for all passengers is required under orders, decisions, and guidelines issued by the CTA. A draft *Code of Practice* has been prepared and circulated to the agencies concerned. The Code was implemented in 1996. For more information, contact:

Accessible Transportation Directorate
Canadian Transportation Agency
Ottawa, Ontario K1A 0N9
Telephone: 1-800-883-1818 or (819) 997-6828
TTY/TDD: 1-800-669-5575 or (819) 953-9705

14.2.2 Commuter Rail Systems

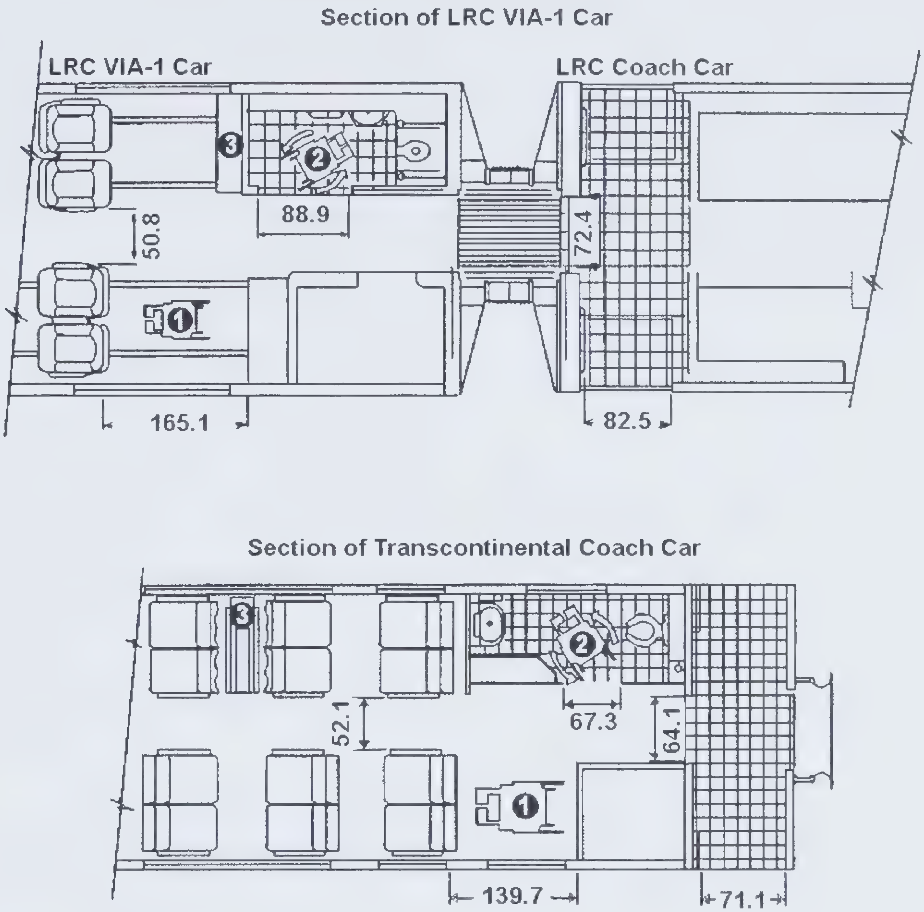
Municipal and provincial commuter rail services are operated under provincial railway legislation. The usual practice is for the operating authority to own the rolling stock and contract out the operation to a major railway company. Accessibility policies on such systems are set by local operating authorities.

14.3 VIA Rail System

VIA Rail Canada Inc., an independent Crown corporation, operates passenger rail service over Canadian National and Canadian Pacific tracks. VIA is responsible for operating, planning, and marketing intercity rail services previously operated by CN and CP Rail. VIA trains connect the eight contiguous provinces, providing transcontinental service between Halifax and Vancouver, high-density rail service in the Quebec City-Windsor corridor, and rail services to isolated communities in northern Quebec, Ontario, Manitoba, and British Columbia.

Major VIA stations have been equipped with portable station-based lifts operated by the station staff, who manually crank a platform from the station level to the railcar-floor level. Where no lifts are available, VIA personnel may lift the person in a wheelchair up to the railcar vestibule.

Each VIA train is equipped with one accessible railcar. Every accessible railcar provides a secured wheelchair location close to the washroom (MacDonald, 1996). Door clearances and aisle widths vary with the type of accessible railcar used on different services (see Figure 14.1).



1 Wheelchair position
2 Accessible washroom
3 Storage for carrier wheelchair

Not to scale. The dimensions shown may vary from one car to another.

(Dimensions in cm)

Figure 14.1 Accessible VIA railcars
(VIA Rail)

Because of the narrow doorways on some railcars, passengers in wheelchairs may be requested to transfer from their personal wheelchairs to narrow on-board wheelchairs for boarding/deboarding. A wheelchair passenger is placed at one end of the railcar, next to the door used for boarding and an accessible washroom equipped with a sliding door, grab bars, and other accessibility features. This procedure is necessary because the aisles are not wide enough for a wheelchair to pass through the entire railcar.

VIA's policy is "to provide transportation and related services to the public without exception, subject to space availability, safety, and an acceptable degree of passenger autonomy. By and through this policy, VIA offers its services to a large cross-section of the public. VIA's only limitations are the numbers of accessible railcars and configuration of the trains, safety, and levels of service expected from the carrier".

In response to the federal requirement that all transportation systems under Transport Canada jurisdiction be fully accessible, VIA Rail developed system-wide terminal design guidelines and standards (VIA, 1983).

14.3.1 Platforms and Lifts

VIA uses the following guidelines for station platforms:

- The station platform should be well lit along its length.
- Each platform should display its name in large letters one or more times along the platform. The track number and train destination should be clearly identified for each track, according to ergonomic sign standards. Information should be given in visual and audible modes (see Figure 14.2).
- The platform edge should be displayed in a contrasting colour and have a tactile strip along its length (see Figure 14.2).
- Wherever possible, the railcar floor and station platform should be at the same level. Where the height difference is more than 5 cm, a station- or train-based lift/hoist should be provided for boarding passengers where traffic volumes warrant this assistance (see Figure 14.3).

14.3.2 Railcars

VIA Rail has made railcars more accessible through station-based lifts; the provision of wheelchair securement systems; and accessible washrooms, food services, and sleeping accommodations (MacDonald, 1996).

VIA has developed the following guidelines for passenger railcars:

- Clearances for all doors (vestibule, railcar, washroom) should be at least 82 cm, wide enough for a wheelchair to pass.
- Thresholds should not exceed 8 mm.
- Doors should be easy to open, automatic, and power assisted; sliding doors are preferable.
- Washrooms must have enough space for a passenger to transfer from a wheelchair to the toilet. The washroom must have support bars at the sides and rear of the toilet to facilitate the transfer. Water faucets should be easy to operate, e.g., automatic or with large push buttons. Mirrors should be inclined toward

the front. The waste receptacle and paper supply should be within easy reach of a person in a wheelchair. The washroom should have an emergency call button to alert rail personnel.

- Every train should have at least one railcar with a designated place for a wheelchair passenger. The space should be large enough to allow for a complete 360 degree turn (1.4 m). The place should not require any preparation by the passenger (e.g., flipping seats, moving a shelf), and should be designated by symbols and text as seating for passengers in wheelchairs. It must be vacated by other passengers should a passenger in a wheelchair board.
- During travel, wheelchairs must be secured by systems installed by VIA. Train personnel are responsible for securing wheelchairs.
- Each railcar should have at least one accessible seat, which has more space in front to make getting in and out with canes, crutches, or walkers easier. It should also be wider; e.g., a double seat with a pivoting centre armrest.
- The aisle width from entrance vestibule to designated wheelchair place and washroom should be at least 76 cm.
- All information (e.g., delays, changes, public announcements, evacuation, or emergencies) should be provided in both audible and visual modes.
- Guide dogs accompanying blind passengers should be provided with an appropriate space.

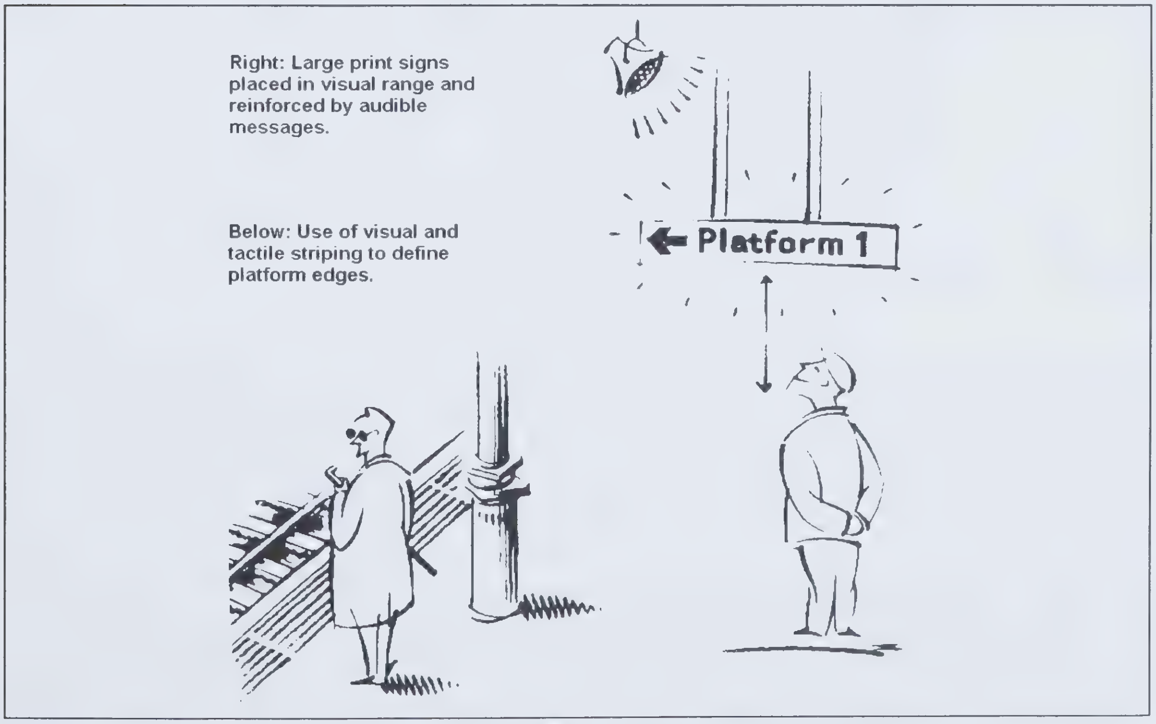


Figure 14.2 Illustration of typical station platform requirements
(British Railways Board, 1989)

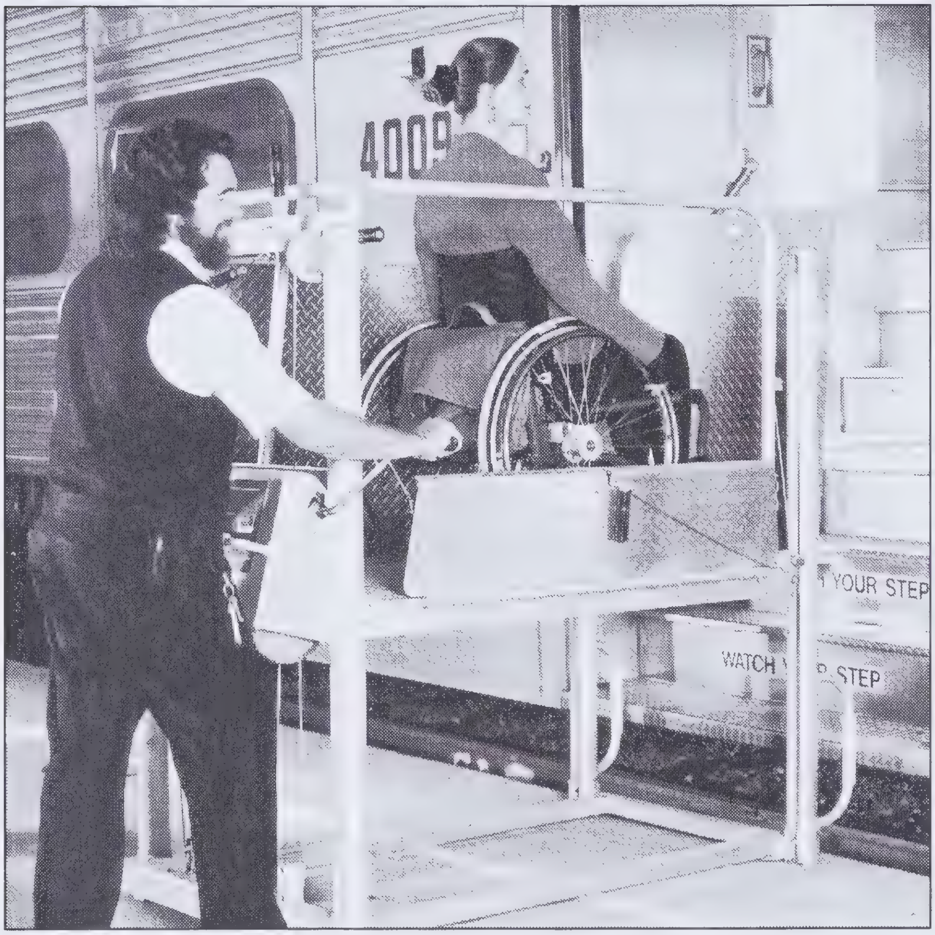


Figure 14.3 Typical technology used to board railcars (Mobilift model TX)
(Adaptive Engineering Ltd.)

14.3.3 On-Board Services

VIA's on-board personnel are expected to provide the following services:

- Assist passengers with disabilities to board and deboard railcars, and move to and from their seats.
- Assist disabled passengers with their baggage when they are boarding and deboarding.
- Be responsible for the care and safety of all passengers, but give particular consideration to the care and safety of passengers with disabilities in an emergency situation and when service is disrupted or delayed for whatever reason.
- Offer passengers with disabilities the same services offered to other passengers; under certain circumstances, this may require that disabled passengers

be served their meals at their seat or accommodation, or be offered other extra services to meet their specific needs.

- Advise rail personnel when passengers require a wheelchair, ambulance, medical attention, or other assistance at their destination.
- Advise rail personnel of the need for second stops at stations with short platforms to board or deboard disabled passengers with the least possible inconvenience.
- Permit persons with visual disabilities who can move about without difficulty to travel on VIA trains with or without an attendant or a service animal. Permit service animals accompanying blind passengers into all facilities, including meal-service and lounge cars.

14.4 Accessible Commuter Rail Services

Commuter rail provides services to inner cities from surrounding suburban areas. These services normally use the same tracks as freight and intercity rail. Because they are limited by the use of these tracks, passenger capacity usually cannot be increased by higher frequency, but only by higher capacity per train (Canadian Urban Transit Association, 1993). Toronto, Montreal, and Vancouver all have commuter rail services. The West Coast Express was inaugurated in November 1995. This new, accessible commuter train operates between Mission, east of Vancouver, and Waterfront Station, the central downtown station, which connects with SkyTrain, SeaBus, and the transit buses.

The two-level West Coast Express railcars have two designated wheelchair spaces. Each car also features a spacious washroom on the lower level near the wheelchair spaces. All West Coast Express stations are equipped with access ramps and automated ticket vending machines (TVMs), the first of their kind in Canada. The TVMs accept four methods of payment: cash; and credit, debit, and stored-value cards.

The commuter rail service in Montreal accommodates ambulatory persons with disabilities. A new service named Montrain, operating between Montreal and Deux Montagnes since October 1995, has two accessible stations. The Montrain cars are equipped with high and low entrances. The high centre doors match the high-level platform in Central Station. The lower level vestibule doors match the low-level platform at the Deux Montagnes terminal.

By June 1995, GO Transit in Toronto had made 10 rail stations accessible. Six months later, the number of accessible stations had increased to 27 out of 49. The new facilities allow passengers who use wheelchairs or other mobility devices to board and deboard independently or with a companion. Customers can make

connections with community paratransit feeders by making prior arrangements with the paratransit systems. (As of 1996, GO Transit buses were not accessible.)

Toronto's Union Station is the central hub of the GO Transit system. Customers can obtain timetables, brochures, and information on accessibility from the Customer Service Centre (GO Transit, 1995).

14.4.1 GO Transit Service Policy

People with mobility aids can use the accessible GO Transit system independently. If they need help, a companion may accompany them free of charge, but must remain with the passenger for the entire trip. The only physical assistance GO Transit staff provide is in using the portable bridge. When large numbers of passengers using mobility devices travel together, advance notice is suggested for proper accommodation.

14.4.2 Information Services

GO Transit provides signs to direct passengers with mobility aids from the entrance of the station to the interior of the railcar (see Figure 14.4).

Information is provided by GO Transit attendants, transit security officers, rail personnel, and the customer service centre. Telephone information is provided for Metro Toronto, Oshawa, Hamilton, Georgetown, Newmarket, Uxbridge, and Barrie on the regular system, as well as on Telecommunication Devices for the Deaf (TDD). The TDD uses a toll-free 800 number. Telephone information is also available for all feeder transit services, and the telephone numbers are provided in the GO Transit rider guide.

14.4.3 Feeder Services to GO Transit

Connections with local feeder transit services are possible at most GO Transit stations. The feeders use accessible transit services and accessible taxis.

14.4.4 Union Station, Toronto

At Union Station, passengers with mobility devices are advised to follow the accessible route, which provides easy-to-open automatic doors. Accessible feeder pick-up and drop-off are provided near the main entrance. Counters are accessible, and accessible washrooms and elevators are provided.

Figure 14.4 Typical GO Transit signs
(GO Transit, 1995)

14.4.5 GO Transit Platform Design

All accessible stations on the GO Transit network, including Union Station, have a ramped mini-platform that brings the station platform level up to the railcar level. The ramped platforms are also convenient for passengers with mobility limitations who use walkers, canes, or crutches, or who may be pushing strollers. The edge of the platform is marked with a brightly-coloured tactile strip. To overcome the remaining height difference and gap between the railcar and the station platform, GO Transit attendants deploy a "bridge" (see Figure 14.5).

14.4.6 Accessible Commuter Railcars

GO Transit has modified 42 of the 331 two-level railcars to accommodate passengers who use mobility devices. Each train has one accessible railcar. The accessible doors are at one end of the accessible railcar, and the train will stop with these doors positioned next to the mini-platform. When required, rail personnel will deploy the bridge for passengers to board or deboard.

Each accessible railcar has eight wheelchair positions on the lower level. Passengers can face forward or rearward and, at their discretion, use retractable belts and buckles to secure their wheelchairs/mobility devices. These positions have fold-down seats that should be vacated by the general public when passengers in wheelchairs need the space (see Figure 14.6). Each location is provided with an emergency call strip, to alert the crew if necessary, and a horizontal grab bar. The two-level railcars do not have accessible washrooms.

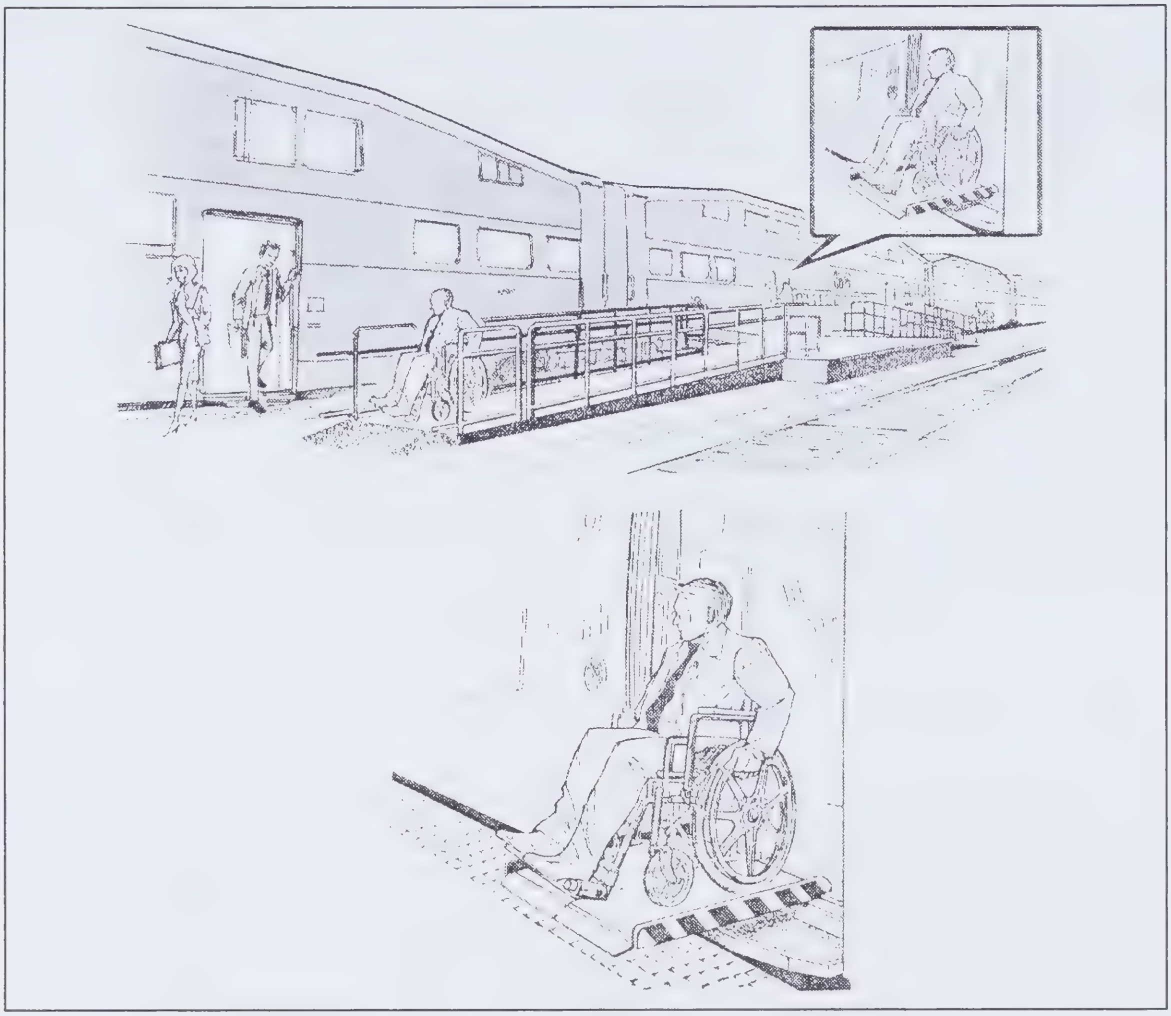


Figure 14.5 GO Transit platform and bridge
(GO Transit, 1995)

14.4.7 Wheelchair Securement Systems

Compared to buses, commuter trains have less pronounced acceleration and deceleration, but they do have a degree of side-to-side swaying and occasional minor lateral thrusts. A passenger railcar is longer, wider, and more massive; consequently, it is more stable and better able to absorb shocks from track imperfections.

Tests by Caltrans (San Francisco State University, 1992) indicate that persons who use mobility devices do not necessarily prefer a secured wheelchair position, but they would like to have the option available. Many passengers in wheelchairs would prefer to transfer to a regular seat and have a seat available beside them for a companion/friend (see Figure 14.7). The current allocation of space for passengers using wheelchairs was also questioned in view of the newer and larger models of battery-powered scooters and wheelchairs.

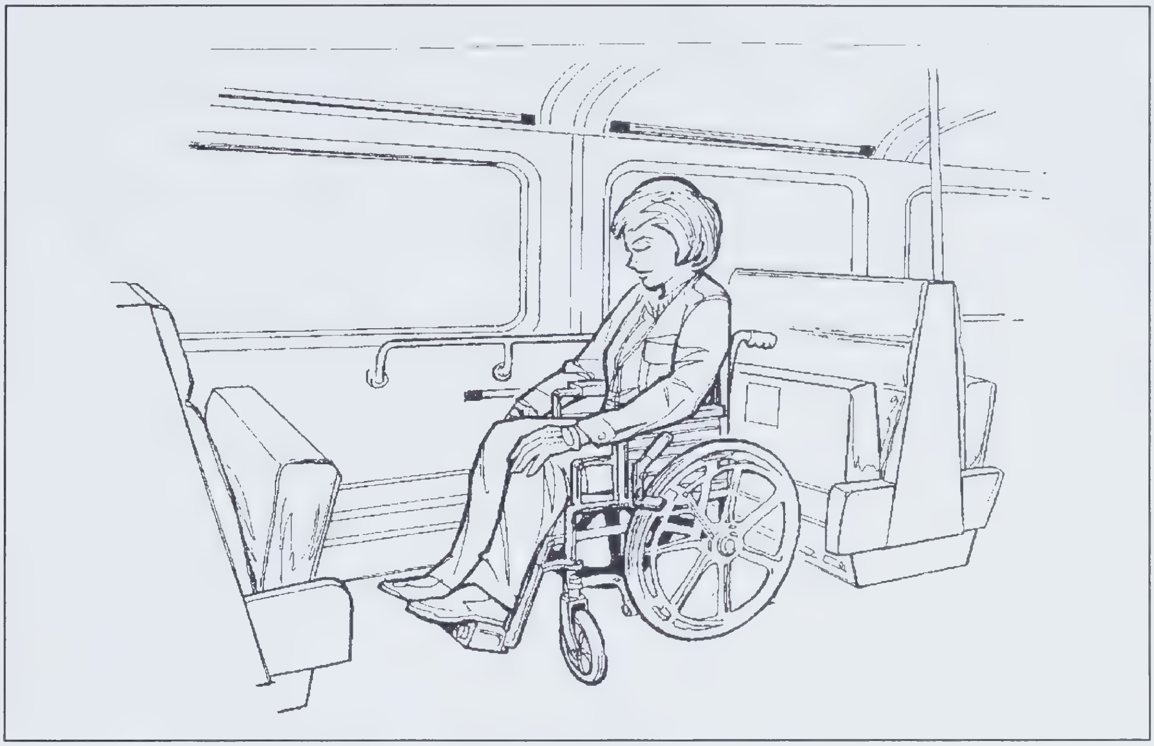


Figure 14.6 Accommodation for passengers using wheelchairs on GO trains
(GO Transit, 1995)

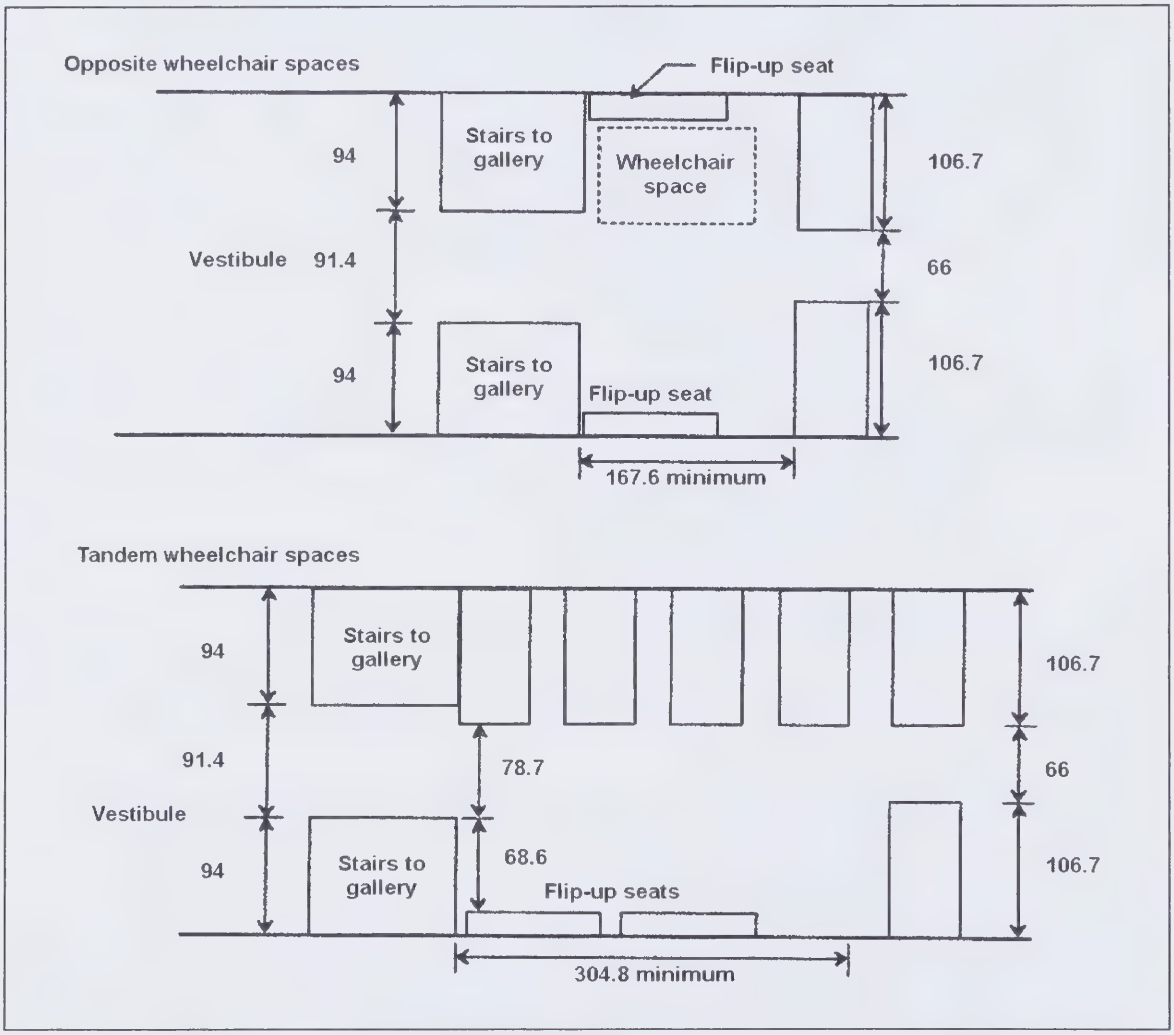
14.5 Guidelines for Planners and Designers

For more detailed planning and design information on accessible intercity rail services, consult:

- Section 3.5 for human factors in design, Section 3.3 for pedestrian access, and Section 3.4 for terminal requirements;
- Section 5.2 for information and communications media and technology;
- Sections 6.3.4 and 6.4.3 for safety requirements;
- Sections 7.6 and 7.7 for staff training programs;
- Section 8.8 for current research and development projects;
- Section 17.2 for multimodal travel requirements, including check lists and an audit process;
- Canadian Standards Association CAN/CSA-B651-95 on *Barrier-Free Design*;
- Carriers that have developed specialized accessibility technology including airlines, GO Transit, VIA Rail, the Greyhound Group of Companies, and the urban rail transit systems in major cities.

Table 14.2 summarizes the infrastructure and customer-service improvements that should be considered to accommodate seniors and customers with disabilities.

The importance of involving the community of persons with disabilities in the design or redesign of rail systems cannot be over-emphasized. For the new West Coast Express system, the planners and designers met regularly for about a year with a group of disabled people to obtain input and feedback. As a result, the system is fully accessible and easy to use.



(Dimensions in cm)

Figure 14.7 Preferred locations for wheelchairs on commuter trains
(San Francisco State University, 1992)

Table 14.2 Recommended infrastructure and customer-service improvements

Infrastructure Recommendations
Provide
• an on-board or station-based level change system
• colour-contrasted markings on steps and platform edges
• tactile maps
• lighting of 200-300 lux adjacent to signs
• tactile information cues and markings
• grab bars and hand rails
• sensor-activated tape messages between railcars
• call buttons in railcars
• information cassettes
• video monitors
• captioning on video monitors
• special menus
• an FM loop communications system
• a standardized washroom layout
Improve
• the washroom occupancy information system
• signs to conform with human-factors principles (see Chapter 5)
• emergency exits
• door-opening mechanisms
Redesign
• the flush mechanism on toilets
Customer-Service Recommendations
Provide
• information brochures
• pre-boarding assistance
Improve
• line-up procedures
• public announcements
• sensitivity training for train crews
• consultation with consumers

- 15 -

INTERCITY BUS SYSTEMS

– 1 – INTRODUCTION

CUSTOMER ACCESS

– 2 – TRIP PLANNING	– 3 – ROADWAYS & TERMINALS	– 4 – PERSONAL VEHICLES

SYSTEM ACCESSIBILITY

– 5 – COMMUNICATIONS SYSTEMS	– 6 – SAFETY & RELIABILITY	– 7 – TRAINING	– 8 – RESEARCH & DEVELOPMENT

PUBLIC CARRIERS: LOCAL

– 9 – ACCESSIBLE TAXIS	– 10 – URBAN BUS SYSTEMS	– 11 – URBAN RAIL SYSTEMS	– 12 – RURAL SYSTEMS

PUBLIC CARRIERS: INTERCITY

– 13 – AIR TRANSPORT SYSTEMS	– 14 – INTERCITY RAIL SYSTEMS	**– 15 – INTERCITY BUS SYSTEMS**	– 16 – MARINE SYSTEMS

– 17 – MODAL INTEGRATION

Related Information: Planning guidelines common to all transportation systems are discussed in Chapters 2 through 8.

15 Intercity Bus Systems

In Canada, intercity bus service between major urban centres is a low-cost, flexible alternative to both rail and air travel, especially for short to medium distances. Bus companies also provide an essential service in many of the more sparsely populated areas of the country. With approximately 50 carriers operating over 2,000 buses, some 50 million passengers are carried annually, half by tour and charter operations, the other half by regular services. Over 3,200 cities, towns, and communities are served by intercity buses, as compared with about 500 served by Canada's passenger rail system (Hallett, 1992).

The intercity bus industry operates over a road and highway network of more than 58,000 km. Largely regulated by provincial agencies, the industry employs approximately 4,500 people. Buses and major terminals are owned and operated by individual companies, which often lease space to other carriers.

Ownership of motorbus companies falls mainly into three categories:

- Publicly traded corporations, whose goals can be described as profit-driven;
- Provincially-subsidized companies for whom social goals, such as service to remote communities and accessibility, may be more important than profit considerations;
- Privately-owned companies, which are often, but not always, small-fleet, family-run operations.

In 1995, the status of accessibility among the major Canadian intercity bus operators was as follows (Clark, 1995):

Acadian Lines Limited (Nova Scotia)

- one accessible bus out of 27
- available on 72-hour notice or less, depending on route assignments

Voyageur Colonial Limited (Ontario and Quebec)

- several accessible buses available, initially, on the Toronto-Kingston corridor
- available on 24-hour notice
- uses a customer tracking system

Greyhound Lines of Canada Ltd. (Western provinces and Ontario)

- a fleet of 24 accessible buses
- available on 24-hour notice
- 90 percent of agency network and terminals accessible
- TTY/TDD systems being installed
- general improvement in information systems

Grey Goose Bus Lines (Alberta)

- two accessible buses ordered

CN Roadcruiser (Newfoundland)

- one accessible bus
- available on 48-hour notice

Pacific Western Transportation (Western provinces and Ontario)

- 16 accessible buses, including 12 serving Pearson International Airport in Toronto, out of a fleet of 50

Trentway-Wagar (Ontario)

- four accessible buses out of over 100

Autocar Connaisseur (Quebec)

- two accessible buses out of 100

Saskatchewan Transportation Company (Saskatchewan)

- two accessible buses out of 43
- available on 72-hour notice
- 800 telephone number

Projections of the 1991 Health and Activity Limitation Survey (HALS) data to the year 1995 result in an estimated 519,000 persons with disabilities who would travel by intercity bus (Goss Gilroy, 1995d). This segment of the long-distance travel market has the following characteristics:

- These travellers represent 13.6 percent of the 3.8 million Canadians with disabilities.
- They are more likely to have mobility, agility, and/or hearing and other disabilities. They are likely to have mild to moderate levels of disability.
- They have relatively modest levels of individual annual employment income, with 64.6 percent having incomes below $10,000 in 1991.
- Of the 519,000 persons who travel by intercity bus, 88.4 percent travel without difficulty.
- Approximately 60,000 (11.6 percent) encounter difficulties with aggravation of the individual's condition; transporting mobility aids; moving around the terminal; boarding/deboarding; and seating on board. Of these, 36,000 persons must limit their travel by intercity bus.

- Approximately 91,000 (17.5 percent) travellers reported difficulties in obtaining information on services and facilities.
- Because of their condition or health problem, approximately 83,000 (16 percent) require an attendant or companion to accompany them on long-distance trips, and 14,000 require specialized transportation services or facilities.
- During the three-month period between April 1 and June 30, 1995, an estimated 248,000 persons with disabilities took long-distance trips by intercity bus, making a total of 544,000 one-way, long-distance trips.

15.1 Accessibility Issues

15.1.1 Customer Needs

From a disabled customer's point of view, each link or component of a bus trip must be accessible. This includes the feeder modes that serve a bus terminal, the parking or drop-off areas, the entrance to the terminal, the ticket counters, the washrooms, the restaurants, and the boarding islands.

An accessible intercity bus should meet the following needs:

- vertical access from the boarding level to the bus floor level;
- access to and egress from a seat;
- provision for wheelchair securement and passenger restraint;
- access to and the use of a washroom;
- communication and access to information.

At present, most urban communities and many rural areas have some form of accessible feeder mode, and large bus terminals are relatively accessible. As illustrated in Table 15.1, several problems remain. If a bus is not equipped with a lift, accessibility from the boarding island to the bus floor is difficult for passengers who cannot negotiate steps and stairs. Access to washrooms at rural bus stops and access from such bus stops to feeder systems and taxi services may also present difficulties.

Observations on the use of accessible intercity buses indicated that, provided these buses stopped at terminals with accessible washrooms periodically (at intervals of two hours), the on-board washrooms were not used by passengers with wheelchairs. Furthermore, persons using wheelchairs preferred to be in the body of the coach with other passengers, not isolated at the rear. Since the aisles are too narrow for wheelchairs, some compromise such as aisle chairs may be necessary.

Table 15.1 Challenging tasks on board intercity buses

Tasks	Customer Disability				
	Mobility	Vision	Hearing	Learning	None
Boarding	X	X	X	X	
Moving within	X	X		X	
Obtaining a ticket	X	X	X	X	
Stowing articles	X	X			
Sitting	X	X	X	X	X
Communicating with driver	X	X	X	X	X
Obtaining information	X	X	X	X	X
Using washroom	X	X	X	X	X
Deboarding	X	X	X	X	X
Emergency procedures	X	X	X	X	

(Arnold, 1993)

15.1.2 Economic Issues

The majority of intercity bus systems are owned and operated by private companies that do not receive any direct operating subsidies. Those that are operated by government agencies, such as the Saskatchewan Transportation Company, are expected to produce revenues for the government.

The bus companies depend heavily on revenues generated from the movement of goods. They compete with the airlines for the fast movement of mail, perishable express, and courier packages, particularly on weekends. They provide the only means of getting time-sensitive materials into small communities and rural areas. In many cases, the revenues from goods movement equal or exceed those from carrying passengers.

The load-carrying capacity of the buses is therefore critical for economic viability. Any modification to the vehicle that reduces passenger seating or cargo space may result in an unprofitable bus route. Furthermore, modifications to provide accessibility add significantly to the capital costs of the vehicles.

Currently, the length limit in Canada for single trucks, trailers, and buses is 12.5 m. The Transportation Development Centre (TDC) and Motor Coach Industries Ltd. of Winnipeg, Manitoba, have developed a 14 m prototype accessible bus for demonstration (Naylor, 1992). The extra length was needed to house a wheel-

chair lift and accessible washroom (see Sections 15.3.2 and 15.4.2 for a discussion of the bus and the demonstration).

Provincial licensing agencies have the power to offer financial incentives for services that private fleet operators might consider to be insufficiently profitable. Thus a carrier might be issued an exclusive licence conditional on making all or a portion of the bus fleet fully accessible. This is how Vancouver was able to acquire accessible taxis (Atkinson, 1985).

Alternatively, the provinces could allow the operation of a longer, more productive bus in return for guarantees of accessibility. The demonstration project illustrated the advantages of a 14 m bus:

- The accessible prototype showed that an on-board lift and wheelchair-accessible washroom can be incorporated, with seating for 48 passengers and no loss of baggage capacity (a 12.5 m bus, with a standard lavatory, seats 47 passengers).
- Without the accessibility features, a 14 m bus with the same equipment as a 12.5-m bus can seat 55 passengers (an increase of 17 percent) and can carry 25 percent more cargo.
- The fuel penalty for the increased weight of the 14 m bus is approximately 5 percent.

An intercity bus company with a mixed fleet of accessible and standard 14 m buses would enjoy a significant productivity advantage.

15.2 Regulation

In Canada the federal Motor Vehicle Transport Act (MVTA) allows the provinces to apply their laws and regulations to extra-provincial bus companies. The only direct federal regulation of these companies is the Commercial Drivers Hours of Service Regulation, 1994, which limits the driving and on-duty time for drivers working for these companies. The provinces regulate the highways through vehicle and motor-carrier legislation. Safety is of prime concern in granting operating licences. The National Safety Code for Motor Carriers, developed by the Canadian Council of Motor Transport Administrators, contains model standards for safety issues and limits the hours of service for bus drivers.

The question of federal accessibility standards for the intercity bus industry has been reviewed by the Royal Commission on National Passenger Transportation and an inquiry into Canadian motor coach services by the National Transportation Agency, now the Canadian Transportation Agency (NTA, 1993). The bus industry is proposing a non-regulatory solution to accessibility.

Numerous provincial and territorial laws and regulations play a role in the day-to-day regulation of the intercity bus industry. Each provincial and territorial

transport board or commission develops its own rules and procedures. These agencies can specify bus routes, capacity, service quality, safety standards, and insurance requirements. Fares can be regulated through tariff filings. In 1996, Ontario introduced legislation to remove economic regulation on January 1, 1998.

Bus companies pay for the use of the highway systems in the form of provincial licences and fuel taxes. Usually they are granted exclusive or semi-exclusive rights to operate a particular route by a motor carrier commission. The maximum allowable sizes and weights for vehicles operating on highways are also regulated. Thus the provinces and territories have the means to impose or remove conditions that affect the economics of the bus industry.

15.3 Accessible Intercity Bus Development

Accessible intercity buses are available from two Canadian manufacturers, as well as from sources in Europe and the United States. Lift technology is the key to accessibility.

TDC has been involved in the development and demonstration of accessible intercity buses for more than 15 years. The feasibility of an integrated lift was first investigated in 1980. The internal lift concept was first developed by Rutenberg for TDC and Prévost Car Inc., and engineered by TES Ltd. This led to the development of several prototypes (Suen and Rutenberg, 1992).

15.3.1 Early Canadian Prototypes

In 1984, TDC sponsored the development of an internal wheelchair lift for a 12.5 m intercity bus. The prototype MC-9 bus was built by Motor Coach Industries Ltd. of Winnipeg. The internal lift was designed by TES Ltd. The lift became known as the *El-Lift* (Suen and Rutenberg, 1992).

In February 1985, the bus was placed in service in Newfoundland by CN Roadcruiser (formerly Terra Transport) (Voelker, 1991). By 1995, the bus had performed satisfactorily for 10 years.

A later version of the Roadcruiser prototype was developed in 1985, demonstrated at EXPO '86 in Vancouver, and placed in service with Canada Coach Lines of Hamilton, Ontario, in 1988. This bus, dubbed the *ACCESSOBUS*, features a lift located curbside in the area normally used as the middle baggage compartment.

A third-generation lift is installed in a Prévost Le Mirage bus manufactured by Prévost Car Inc. of Pointe-Claire, Quebec (Lessard, 1990). This lift takes up less baggage and passenger space, has a lighter platform, and features simpler controls (see Figure 15.1).

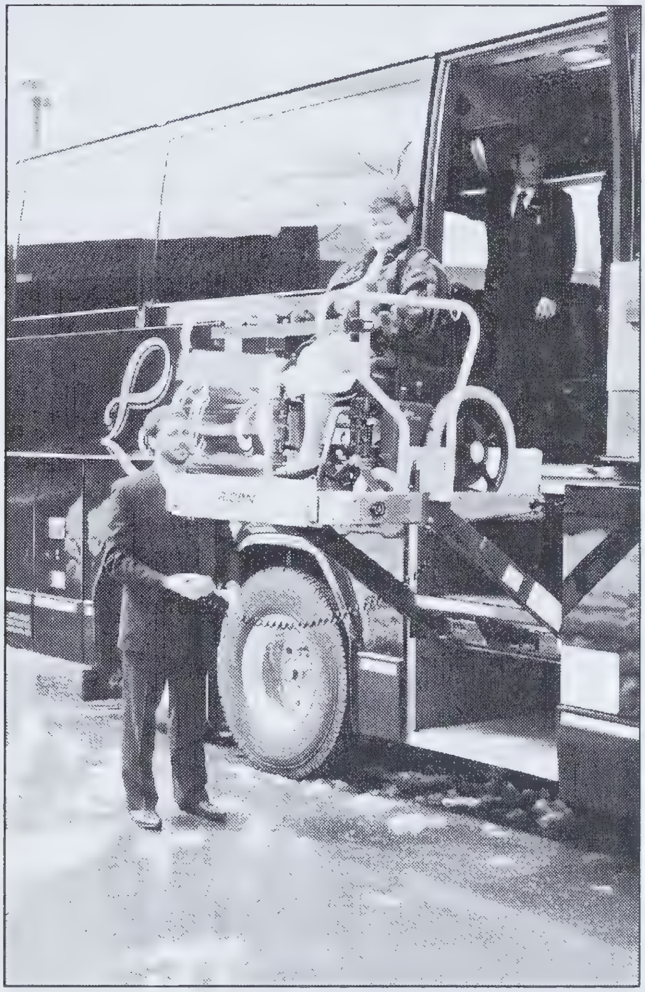


Figure 15.1
Third-generation intercity bus lift – Prévost Le Mirage bus
(Prévost Car Inc. and Ricon Canada)

15.3.2 Development of a 14 m Bus with an Accessible Washroom

In this shared-cost, government-industry project Motor Coach Industries Ltd. developed, built, and tested a prototype 14 m intercity bus (Arnold, 1991; Naylor, 1992).

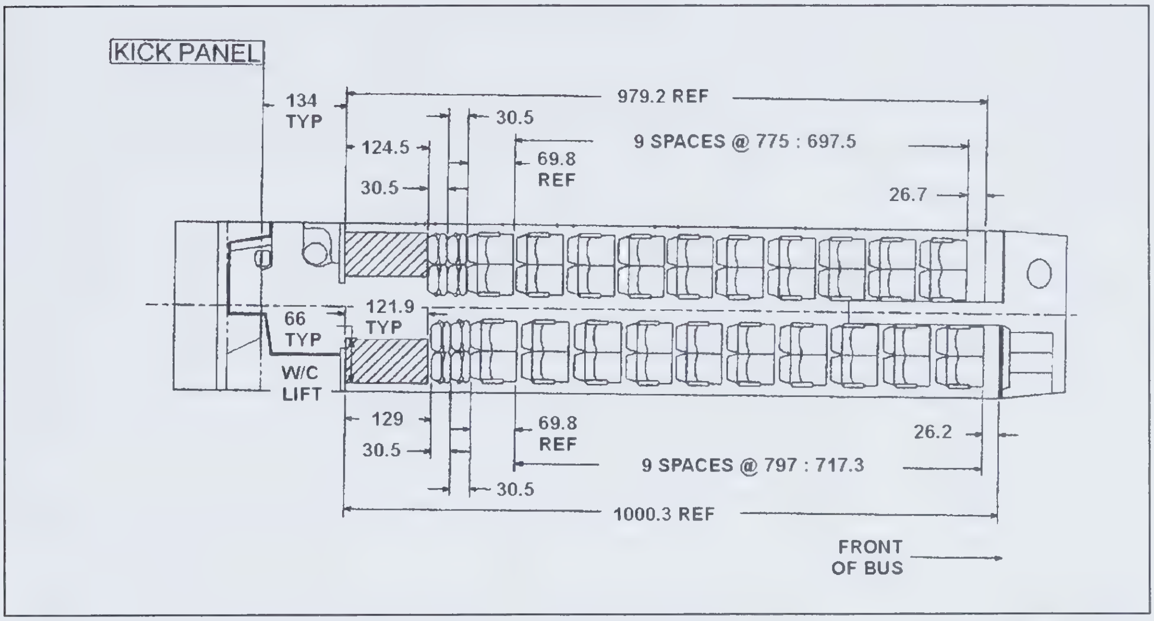
The prototype vehicle uses the additional 1.5 m length to accommodate a fully accessible washroom and an on-board wheelchair lift at the rear of the bus. A unique hinged partition allows this area to serve a dual function: the boarding area provides additional space for the washroom when the partition is moved. This unique design was developed by Rutenberg Design Inc. of Kanata, Ontario (Rutenberg, 1989). Passenger seats in front of the washroom bulkhead feature a fold-and-slide option to create space for two wheelchair securement positions when required.

The boarding sequence is as follows: A canopy door opens at the rear of the bus to provide some protection from rain while the passenger in a wheelchair is being

raised to bus floor height by the lift (see Figure 15.2). The passenger then proceeds past the closed-off washroom section and through automatic sliding doors to the designated travel position, which has been prepared by folding and sliding four passenger seats per wheelchair (see Figure 15.3). The driver moves the hinged partition to the alternative position, closing off the stowed wheelchair lift and exterior door, and at the same time enlarging the washroom space to make it wheelchair accessible. The automatic sliding doors used to reach the passenger compartment now provide access to the washroom (see Figure 15.4).

The wheelchair lift used on the bus represented a significant portion of the development effort. The passenger faces in for boarding and faces out for exiting, thus making these operations easier and more user-friendly than those of most other lifts currently in use on intercity buses. In addition to its smooth operation and stability, the lift features a guard rail that surrounds the occupant, creating a greater sense of security; this is particularly important, because the passenger floor height of intercity buses typically exceeds 1.3 m.

Figure 15.2 Wheelchair lift and canopy door
(Motor Coach Industries Ltd.)



(Dimensions in cm)

Figure 15.3 Layout showing sliding seating for customers using wheelchairs
(Motor Coach Industries Ltd.)

Figure 15.4 Interior view of accessible washroom
(Motor Coach Industries Ltd.)

15.3.3 Front-Access Lift Technology

At present, one of three access points is used to enable passengers in wheelchairs to reach bus floor level from the road: the front door, the midsection, and the rear side door (Asselin, 1986). The front door offers a very economical solution, as no structural modification to the bus is necessary, and all passengers can use the same entrance. However, its use is limited: the boarding device must be station-based and available at every stop; and, more seriously, the 63.5 cm door clearance width is not enough for most wheelchairs, so only those who can transfer to a narrower boarding chair or bus seat can enter. Other disadvantages include lack of an appropriate landing space, transfers restricted to the first row only, and narrow aisles that prevent access to the washroom.

Two boarding concepts for access through the front door were developed under TDC sponsorship by the Rehabilitation Centre, Ottawa, and the University of Ottawa (O'Riain, 1990): an electrically powered stair-lift and a foldable mobile ramp system. Subsequently TDC sponsored the development of the AXIS Boarding System (a bus modification kit) by Questa Design and Engineering Ltd. The AXIS system includes a retractable low-rise staircase with highly visible yellow handrails, non-skid step treads, improved lighting, and a door that opens a full 90 degrees. The system can be deployed quickly for persons with agility, mobility, or sensory disabilities. It also makes boarding easier for ambulatory passengers (Questa, 1996).

Another project under development is a portable Bus Lift and Transfer Chair by Adaptive Engineering Ltd. of Calgary, Alberta. The project involves an adaptation of the Mobilift AX technology used to provide access to small aircraft (see Figure 13.6).

15.3.4 Accessible Charter Bus Development Project

In 1993, TDC undertook an R&D project to develop accessible charter bus travel. For the purposes of this project, a charter bus was defined as "an intercity bus capable of transporting at least 30 passengers" (Clark, 1995). The project was intended to facilitate recreational travel by seniors and persons with disabilities.

This work included:

- identification of the barriers to intercity bus travel, the requirements of travellers with disabilities, and the characteristics of the intercity bus industry;
- development of design alternatives to improve accessibility to intercity buses;
- development of a prototype accessible passenger seat module;
- development of a sensitivity-training program for intercity bus personnel;
- development of prototypes of two accessible boarding systems;
- demonstration of the resulting improvements in accessibility.

The impact of this project has been substantial: Motor Coach Industries Ltd. has incorporated several new accessibility features into a new vehicle, the AXIS Boarding System was developed for existing fleets (see Section 15.3.3), a new bus seat was designed, and several new initiatives were proposed for the intercity bus industry.

The proposed initiatives include:

- development and deployment of some low-floor buses as an alternative to lifts;
- more emphasis on training as the single most cost-effective improvement in accessibility;
- coordination and integration of transportation modes and services.

15.4 Demonstration Services

To test the prototype intercity buses, TDC sponsored two demonstration projects: one based in Hamilton, Ontario, and the other in Calgary, Alberta.

15.4.1 Kitchener-to-Buffalo Bus Route

The prototype design known as *ACCESSOBUS* was placed in service by Canada Coach Lines of Hamilton, Ontario. A three-year accessible bus demonstration service along a main corridor route from Kitchener-Waterloo through Hamilton, St. Catharines, and Niagara Falls to Buffalo, New York, was launched in October 1989. With six lift-equipped buses, every scheduled departure along this 180 km route was accessible. While ridership by people who use mobility aids grew slowly from about six to eight trips per month, by July 1990 it had reached a high of about 30 trips per month. Ninety-seven percent of trips taken by persons with disabilities were made by those who use wheelchairs. About one-third of these travellers were accompanied by attendants, at no additional charge. Customers rated the service from "very good" to "excellent" and gave Canada Coach Lines staff high marks for safety and driver courtesy (Palomba, 1993).

15.4.2 Calgary-to-Edmonton Bus Route

On November 30, 1992, Greyhound Lines of Canada Ltd. inaugurated an accessible daily bus run between Calgary and Edmonton, with an intermediate stop in Red Deer. TDC and Alberta Transportation shared the costs of the demonstration service. The specially designed and equipped 14 m bus described in Section 15.3.2 was used.

Customers were requested to call Greyhound's information number to reserve space on the accessible bus. Greyhound staff were trained to obtain information about customer needs and the type of mobility equipment used. Customers were asked to arrive at the terminals at least 45 minutes prior to bus departure to pick up tickets and pre-board the bus. Provision was made for booking accessible feeder services at the destination point. One fare covered the passenger and an attendant, if required (Naylor, 1992).

15.5 Guidelines for Planners and Designers

Service planners and equipment designers who require a fuller discussion of this topic should consult the following:

- Section 3.5 for human factors in design, and Sections 3.3 and 3.4 for pedestrian access to and within terminals;
- Section 5.2 for information and communications media and technology;
- Sections 6.3.5 and 6.4.1 for improvements in safety;
- Section 7.6.3 for staff-training programs;
- Section 17.2 for multimodal travel requirements;
- Canadian Standards Association CAN/CSA-B651-95 on *Barrier-Free Design*;
- Carriers that have developed specialized accessibility technology, including the airlines, GO Transit, VIA Rail, the Greyhound Group of Companies, and the urban bus transit systems in major cities.

Table 15.2 presents a summary of the infrastructure and customer-service improvements that should be considered to accommodate seniors and customers with disabilities. The following subsections provide additional details for planners and designers.

15.5.1 Accessible Washrooms

Typical requirements for on-board accessible washrooms include the following:

- an automatic entrance door;
- accessible and unisex symbols and occupancy signs;
- a full 360-degree manoeuvring space for mobility devices;
- access to the toilet from left, right, and central transfer positions at a height of 47 cm;
- all controls within easy reach from a wheelchair and standing position;
- hand and support rails around the interior perimeter;
- handrails and controls colour coded with contrasting colours;

- tilting mirrors that can be adapted for users of different heights;
- automatic faucet and soap dispenser;
- a large push-button for toilet flushing;
- control functions located within reach of a person seated on the toilet.

15.5.2 Communications and Cueing Systems

The following bus design techniques benefit customers with disabilities:

- step edges highlighted with strong, contrasting colours;
- strong lights in stairwells;
- handrails left and right in the stairwell for support guidance;
- a speaker system for the driver's messages;
- lights on the floor during night operation to indicate aisle width;
- monitors to convey visual messages to passengers;
- tactile messages along emergency exit window sills.

Prévost Car Inc. buses on Voyageur's Montreal-Quebec City route and Motor Coach Industries Ltd.'s accessible intercity buses are equipped with these features. Communications systems common to all modes and terminals are discussed in Chapter 5.

Table 15.2 Recommended infrastructure and customer-service improvements

Infrastructure Recommendations

Provide
- courtesy seating
- colour-contrasted markings on steps and platform edges
- tactile maps
- lighting of 200-300 lux adjacent to signs
- tactile information cues
- tactile markings
- call buttons
- information cassettes
- video monitors
- captioning on video monitors
- a safety video
- flashing lights and alarm bells during emergencies

Improve
- seat numbering
- washroom occupancy information system
- signs to conform with human-factors principles (see Chapter 5)
- emergency exits
- door-opening mechanisms

Standardize
- the washroom layout

Consider
- an FM loop communications system

Customer-Service Recommendations

Provide
- readily available information brochures, fares, and schedules
- pre-boarding assistance

Improve
- queuing procedures
- public announcements
- sensitivity training for crews

– 16 –

MARINE SYSTEMS

– 1 – INTRODUCTION

CUSTOMER ACCESS

– 2 – TRIP PLANNING	– 3 – ROADWAYS & TERMINALS	– 4 – PERSONAL VEHICLES

SYSTEM ACCESSIBILITY

– 5 – COMMUNICATIONS SYSTEMS	– 6 – SAFETY & RELIABILITY	– 7 – TRAINING	– 8 – RESEARCH & DEVELOPMENT

PUBLIC CARRIERS: LOCAL

– 9 – ACCESSIBLE TAXIS	– 10 – URBAN BUS SYSTEMS	– 11 – URBAN RAIL SYSTEMS	– 12 – RURAL SYSTEMS

PUBLIC CARRIERS: INTERCITY

– 13 – AIR TRANSPORT SYSTEMS	– 14 – INTERCITY RAIL SYSTEMS	– 15 – INTERCITY BUS SYSTEMS	**– 16 – MARINE SYSTEMS**

– 17 – MODAL INTEGRATION

Related Information: Planning guidelines common to all transportation systems are discussed in Chapters 2 through 8.

16 Marine Systems

Canada's ferry systems include coastal ferries that provide important links between Canada's mainland and islands, and passenger ferries that provide inter-urban links in regional transportation systems. Numerous automobile ferries provide alternatives to bridges in the provincial highway networks; however, these ferries serve trips of short duration that do not normally require pedestrians to make a level change. This chapter, therefore, discusses level changes, either on board an automobile/pedestrian ferry or to board a pedestrian ferry. Both present design challenges in making them accessible to people with disabilities.

For constitutional and historical reasons, Transport Canada provides direct financial support to ferry services in eastern Canada and indirect support to ferry services in British Columbia. This has allowed Transport Canada to be directly involved in ensuring that the Atlantic ferries are accessible, and to have some influence on services on the Pacific Coast.

Projections of the 1991 Health and Activity Limitation Survey (HALS) data to the year 1995 result in an estimated 440,000 persons with disabilities who would travel by marine/ferry systems (Goss Gilroy, 1995e). This long-distance travel has the following characteristics:

- These travellers represent 11.6 percent of the 3.8 million Canadians with disabilities.
- They are more likely to have mobility, agility, and/or hearing and other disabilities. They have relatively higher levels of individual annual employment income, with 33.4 percent having incomes over $25,000 in 1991.
- Of the 440,000 persons who travel by marine systems, 90.9 percent travel without difficulty.
- Approximately 11,000 (2.5 percent) encounter difficulties with aggravation of their condition, transporting mobility aids, hearing announcements, boarding/deboarding, and seating on board.
- Approximately 67,000 (15.3 percent) of marine travellers reported difficulties in obtaining information on services and facilities.
- Because of their condition or health problem, approximately 65,000 (14.7 percent) require an attendant or companion to accompany them on long-distance trips and 11,000 require specialized transportation services or facilities.
- During the three-month period between April 1 and June 30, 1995, it is estimated that 202,000 persons with disabilities made 474,000 one-way long-distance trips by marine systems.

16.1 Accessibility Issues

The Marine Atlantic Advisory Task Force, established in 1980, made a number of recommendations to ensure that passengers with disabilities could use federally subsidized ferry service as easily as other Canadians. As a result, all Marine Atlantic terminals are wheelchair accessible.

Information systems have been provided to advise passengers of the accessibility of vessels, and of the lifts and elevators available for transferring passengers with disabilities between decks.

On both coasts, new vessels have been built according to barrier-free standards (Transport Canada, 1986), and some vessels have been retrofitted (see Sections 16.2.2 and 16.5).

Like travel by other forms of transportation, a ferry trip usually involves other modes of travel and depends on easy access by pedestrians. In addition to making the vessels and docking facilities accessible, the operating authority must consider the following:

- communications systems for schedule information, parking procedures, and reservations, if any (see Section 5.2.2);
- accessibility of terminals (see Section 3.2.3);
- automobile embarking and disembarking priorities (see Section 16.3);
- crew training and performance (see Section 7.6);
- safety issues (see Sections 6.3.6 and 6.4.4).

16.1.1 Potential Barriers in Ferry Systems

Barriers to full accessibility on ferry systems may occur when:

- gaining access to facilities in the terminals;
- embarking on the vessel;
- transferring between decks (use and location of elevators);
- using stairs;
- gaining access to washrooms and facilities on board;
- crossing thresholds/sills on doors;
- undergoing evacuation and emergency procedures;
- accessing on-board customer communications and information.

Other potential problems are related to:

- lack of sensitivity training and awareness of crew members;
- use of safety devices, such as life jackets;
- use of other on-board facilities, including cabins, cafeterias, cinemas, and passenger lounges.

16.1.2 Technology Used to Overcome Barriers

The following devices can be used to provide access to persons who use wheelchairs:

- hydraulic or cable-operated elevators (corrosion resistant for marine conditions) between decks;
- open wheelchair lifts for small vertical lifts; these are governed by Canadian Standards Association (CSA) standards for elevation changes of less than 2.5 m, and are used only for transfers between two levels – not decks or floors;
- wheelchair platforms that move up stairways by means of a gear drive and wall-mounted tracks;
- portable stair climbers that attach to a wheelchair and climb staircases by means of a track-drive system.

16.2 Regulation of Ferries

Harbour and coastal ferries in Canada are regulated by the federal Public Harbours and Ports Facilities Act and the Canadian Transportation Act, 1996. For further details, consult Transport Canada or the Canadian Transportation Agency (CTA). Under new guidelines issued by the CTA, entitled *Ferry Accessibility for Persons with Disabilities: A Code of Practice,* ferries must be accessible for all passengers.

The Ship Safety Branch of Transport Canada regulates the design and construction of ships, including their machinery, outfitting, and equipment. It defines the proper methods for loading, unloading, and stowing cargo; and sets national standards for safe working practices in ships, including: the use of life jackets and other emergency flotation devices; the number, qualifications, and certification of sea-going personnel; bridge-to-bridge communications between ships; and safe navigating procedures.

16.2.1 Standards for Elevating Devices

Elevating devices installed on Canadian ships and ships engaged in the coastal trade of Canada must meet the requirements specified in the Canada Shipping Act and its regulations. The installation must be approved by the Ship Safety Branch as well as by the Ship Classification Society. The regulations state that the device must comply with CSA standards, which include the following:

- CAN 3-B44-M85 *Safety Code for Elevators* establishes minimum requirements for the design, construction, installation, operation, inspection, testing, mainte-

nance, alteration, and repair of elevators, dumbwaiters, escalators, moving walks, freight platform lifts, and their hoistways or wellways, and temporary use of permanent elevators for carrying workers or materials. Although this standard does not apply specifically to elevating devices for persons with disabilities, it can be used as a general guide for safe design practice.

- CAN/CSA-B355-M86 *Elevating Devices for the Handicapped* is referenced from CAN 3-B44-M85 and specifies the minimum requirements for the design, construction, installation, operation, inspection, and testing of elevating devices that are to be used specifically by persons with disabilities. The requirements are designed to safeguard operators and users against risk of accidents.

16.2.2 Ferry Accessibility Provisions

The Accessible Transportation Directorate of the CTA prepared new *Ferry Accessibility Provisions*, dated October 12, 1995. A working draft was circulated to the carriers and to members of the CTA's Advisory Committee on Accessible Transportation. Subsequently, in May 1996, the CTA circulated a revised draft, entitled *Ferry Accessibility for Persons with Disabilities: A Code of Practice*. Revisions are still under way.

The proposed regulations cover the following subjects:

- signage (size and placement; electronic and tactile)
- illumination guidelines
- stairways
- handrails
- corridors, passageways, and aisles
- floors (safety requirements)
- doorways and doors
- carrier-owned wheelchairs
- telephones (placement, TTY/TDD provision)
- alarms (visual and auditory)
- vehicle decks (accessibility)
- elevators (provision, signage)
- passenger lounges
- cafeterias (seating, handrails)
- washrooms (provision, equipment)
- cabins
- maintenance
- filing a complaint

16.3 Coastal Ferries

In eastern Canada, these services are operated by Marine Atlantic Inc. (formerly CN Marine Inc., a Canadian National subsidiary) under fixed-price contracts with the federal government, which determines service levels and rates. The six Marine Atlantic Inc. services are as follows:

- North Sydney, N.S., to Channel-Port aux Basques, Nfld.
- North Sydney, N.S. to Argentia, Nfld. (summer only)
- Cape Tormentine, N.B., to Borden, P.E.I. (discontinued since Confederation Bridge was completed)
- Saint John, N.B., to Digby, N.S.
- Yarmouth, N.S., to Bar Harbour, Maine, U.S. (summer only)
- Lewisporte, Nfld., to Nain, Labrador (summer only)

Other federally subsidized services in eastern Canada include Wood Islands to Caribou, Souris to Cap-aux-Meules, St. Barbe to Blanc-Sablon, Placentia Bay to Argentia, Jackson's Arm to Harbour Deep, and Grand Manan Island to Blacks Harbour. On the west coast, the British Columbia government exercises full responsibility for ferry and coastal shipping subsidies in return for an annual federal grant, indexed to cover inflation.

Since 1981, new vessels acquired in British Columbia have elevators and accessible washrooms, as do Marine Atlantic Inc. vessels. Similar provisions were made in older ferries when they were "stretched" to increase their carrying capacity. Terminal facilities have also been upgraded. Trailer units with ramps and accessible washrooms were installed in the parking areas at BC Ferries' terminals until the main terminals could be rebuilt.

The embarkation process for passengers who require assistance on BC Ferries is typical of the priority treatment provided. At the time of purchasing a ticket, a passenger is required to notify the cashier of any assistance needed. A card marked "E" is placed on the windshield of the automobile, and the driver is directed to a specific holding area. When the vessel is loaded, ferry attendants assign these automobiles to areas adjacent to the vessel's elevator. Assistance is provided to gain access to the elevator system, which is operated by a ferry attendant.

For passengers with disabilities who wish to travel as "foot passengers", reserved parking is available close to the terminal. The British Columbia terminals are also served by accessible bus systems.

16.4 Urban Passenger Ferries

A number of ferry services in Canada, including the Halifax-Dartmouth ferry, the Quebec-Levis ferry, and the SeaBus in Vancouver, are part of the regional transportation system.

SeaBus, the Burrard Inlet harbour ferry, is operated as an integral part of the Vancouver transit system. With a peninsular downtown area separated by Burrard Inlet from North Shore residential areas, a need for a high-capacity water-borne transit service was recognized in Vancouver in the late 1800s (Kopystynski, 1979).

The unique wheelchair-accessible vessel designed for the SeaBus service, shown in Figure 16.1, incorporates a number of features to provide high capacity and efficient passenger movement:

- A double-ended catamaran configuration provides maximum capacity for a given length and good resistance to heel (longitudinal tilt) while loading and unloading. Vessel capacity is 400 seated passengers.
- Six double doors per side allow flow-through passenger embarkation/ disembarkation and minimize terminal times.
- Passengers who use wheelchairs are given priority locations in the bow.

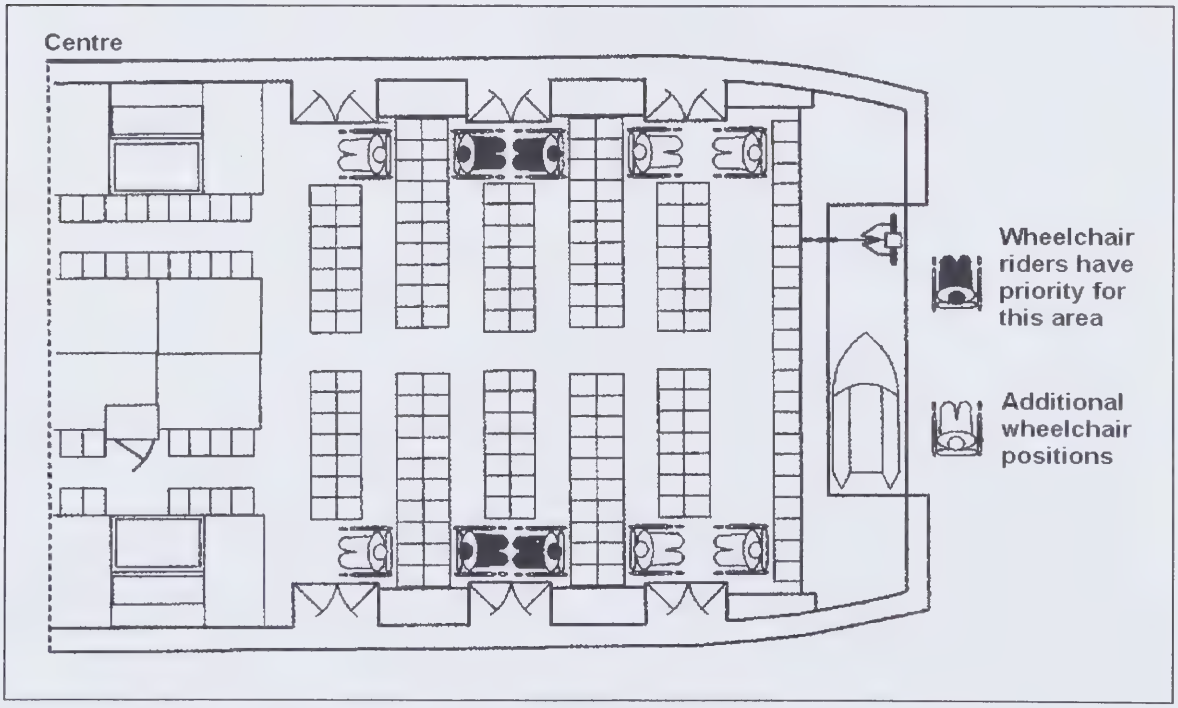


Figure 16.1 Designated wheelchair locations on the Burrard Inlet SeaBus in Vancouver
(BC Transit, 1991)

With two ferries operating from specially designed floating terminals, capacity of the trans-inlet ferry is currently 2,400 passengers per hour in the peak direction. A system of elevators, escalators, and ramps provides terminal accessibility. Transit attendants are located at each of the SeaBus terminals and on board each ferry. However, a person with a disability who requires special assistance to negotiate the terminal ramps, entries, or exits, or to embark on SeaBus, must be accompanied by a personal attendant (BC Transit, 1991). Passengers with disabilities are advised as follows:

- Passengers should make their needs known to a transit attendant, and request assistance whenever necessary. Access to SeaBus is provided by ramps at Lonsdale Quay (North Vancouver terminal.) Access at the Waterfront Station requires the use of an elevator.
- At the "Fare Paid Zone", a SeaBus attendant will open one of the two fire exit doors for passengers using mobility devices.
- Passengers must show a valid ticket or pass to the attendant.
- Passengers must wait in the holding area before embarking.
- Passengers using mobility devices should move into the vessel and position themselves just inside the doors, either in the aisle or in front of a vacant seat. Wheelchairs and scooters should face front or back (see Figure 16.1 for locations).
- Passengers in wheelchairs must lock brakes. SeaBus has no wheel clamps or securement straps.
- Passengers are reminded that tidal changes affect the ramp grades at the terminal entrances.

All SeaBus staff engage in regular drills to ensure smooth and efficient procedures in the event of an emergency. Life jackets are located under each seat, and two life rafts may be deployed, if necessary, under the supervision of SeaBus officers. Any passenger who requires assistance with a life jacket will be assisted by a SeaBus attendant. Upon docking at the terminal, attendants will direct passengers to disembark quickly and calmly.

The SeaBus service is integrated with the other accessible transit services: SkyTrain at Waterfront Station and lift-equipped buses at both terminals.

16.5 Development of a Level-Change System

The following sections describe the development of a single-lift level-change system suitable for coastal marine vessels.

The level-change system on board the ferry MV *Prince Edward* was evaluated by representatives of the National Transportation Agency. Their evaluation is pre-

sented in the NTA *Report of the Inquiry into Level of Accessibility of Ferry Services* (Mozersky, 1992). This report strongly recommended that all efforts should be made to provide systems that would render more ferries accessible.

16.5.1 Background

A major accessibility barrier for persons with disabilities existed on two older Atlantic ferries: the MV *Prince Nova* and the MV *Prince Edward*, which were expected to remain in service for several years. The Marine Policy and Programs Group at Transport Canada asked TDC to undertake a project to define and correct the level-change problems on these vessels and other federally subsidized vessels that were not equipped with level-change systems. The design and implementation phases of the project were conducted by W. R. Davis Engineering Ltd., in conjunction with German & Milne Inc. (Naval Architects) and Behavioural Team, a corporation under contract with TDC (Coppens, 1990; Belloni, 1992).

The design was submitted for approval to the Canadian Coast Guard and to Lloyd's Registry of Shipping.

The project was a typical three-phase research, development, and implementation undertaking. The first phase consisted of problem definition, concept development and selection, and a plan for follow-up work. Phase two involved system and equipment design, development, and manufacturing. The third phase comprised installation of the system on board the MV *Prince Edward* and a performance evaluation by passengers and operators.

16.5.2 Design Guidelines

The following guidelines were applied to the design of the level-change system:

- All relevant safety standards, elevator/lift standards, and marine vessel construction and electrical standards must be applied in the detailed design of the lift system.
- The lift system should provide service between the vehicle deck and the passenger deck for one passenger in a wheelchair or for one physically disabled passenger with an attendant. The lift system should be as compact as possible to minimize lost deck space.
- The lift system should be as maintenance free and reliable as possible; it should be able to operate at sea.
- The installation should require minimal mechanical, structural, and electrical modifications to the ship.

- The total system costs, including operating and maintenance costs, should be as low as possible.
- The lift system should be ergonomically suitable for both passengers and attendants.
- The lift system should provide the utmost in safety and reliability during emergency operations.
- The system should be as aesthetically pleasing as possible.

16.5.3 Manufacture and Installation

Handicap Equipment Ltd. was selected to provide a custom-designed level-change system for the MV *Prince Edward*. The system design and development was to take into account past experience, all of the design criteria, and overall cost. Pictou Industries Ltd. was selected for the retrofit work.

A custom hydraulic/cable lift system was manufactured by Concord Elevator to the developed specifications, and assembled, installed, and tested on board the MV *Prince Edward* (see Figure 16.2). The timing of the installation was coordinated to suit the ship's owners, Northumberland Ferries Ltd., Pictou Industries Ltd., Handicap Equipment Ltd., and the Canadian Coast Guard. The system was installed and commissioned prior to opening of the 1991 sailing season, which started in May and continued until December. The functional testing and commissioning was designed to ensure that the complete system was safe and that all design and applicable standards and regulation requirements were met. Subsequent to this evaluation, the MV *Prince Nova* was also fitted with an elevator system.

16.5.4 In-Service Evaluation

The evaluation team monitored the system's mechanical and human factors performance during the first year of operation. A questionnaire for the passengers and a questionnaire for the attendants helped in obtaining the required data.

The areas of concern addressed in the evaluation and questionnaire included:

- ease of operation for attendants;
- helpfulness of portable ramp for getting into the lift system;
- appearance and performance of the lift system between the two deck levels;
- reliability and ease of maintenance;
- attendants' and passengers' acceptance of the system;
- overall safety of the lift system for the vessel attendants and passengers.

The averaged results from the passenger questionnaires indicated that passengers would prefer a larger lift system and would appreciate additional signs indicating a lift service for passengers with disabilities.

The passengers indicated that, in general, the system was safe and enjoyable, and provided excellent service. Many commented that all ferries should be equipped with such a level-change system.

The attendants indicated that they much preferred the lift system over having to carry passengers with disabilities up or down the stairs. They indicated, however, that ramp positioning and storage was a nuisance and that they would prefer a larger lift.

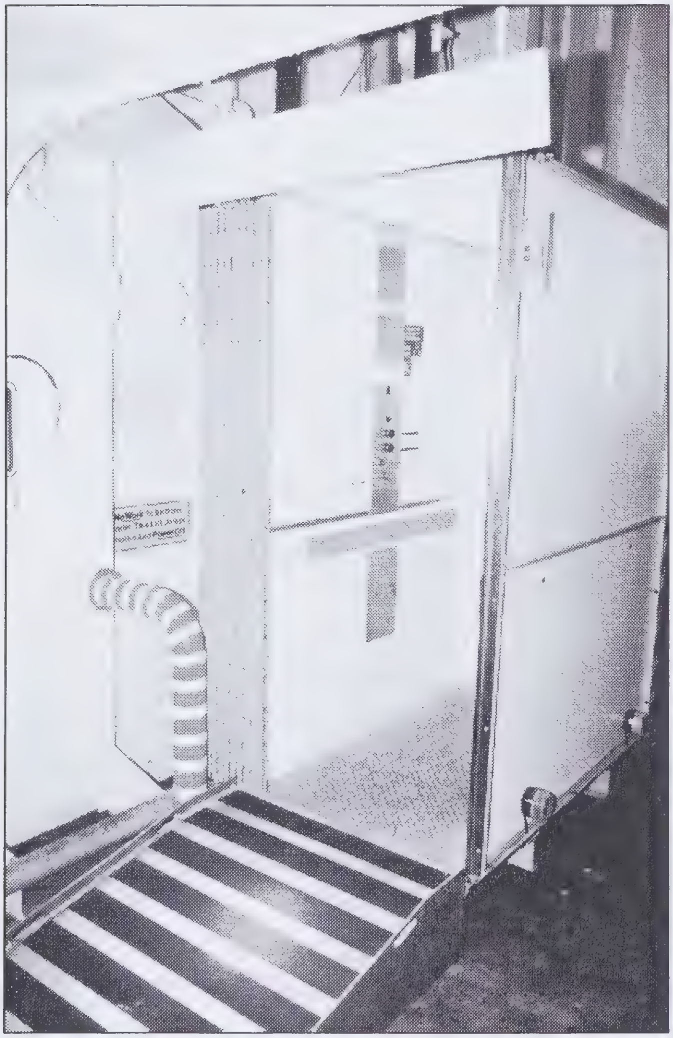


Figure 16.2
Interior view of the level-change system at the passenger deck level
(Transportation Development Centre)

16.5.5 Technical Specifications

The following lists the major elements of the technical specifications:

- The lift system must be suitable for a wheelchair user and lift operator, and provide service between the passenger deck and the vehicle deck. Basic lift dimensions must be 1.4 m x 1.5 m.
- The lift system must meet all applicable regulations, including:
  - CAN/CSA-B355-M86;
  - CAN-3-B44-M85 and LAN-3-B44SI-87 Regulations, Section 38 CSA C22.1 1990;
  - *Barrier-Free Design Standards for Ferry Services* by Marine Policies and Programs, November 18, 1986.
- Signs and controls must comply with the International Symbols of Accessibility, and all applicable lift and elevator regulations should be provided.
- A "fail-safe" control system must be provided that requires the operation of the system by two attendants, one in the cab and one on the car deck, to ensure a clear descent path.
- All required safety measures, such as interlocking doors, emergency stop buttons, keyed on-off switch, emergency lighting, and audio systems, must be provided.
- Back-up power for emergency lowering of the cab must be provided.
- Manual means to lower the cab must be provided.
- Proper operation of the lift under marine environments and in temperatures ranging from -40°C to +40°C must be ensured.

Separate specifications covered modifications to the ship's structure and equipment, as performed by Pictou Industries Ltd.

16.6 Development of Accessible Docking Facilities

In 1993, TDC undertook to develop concepts for the provision of barrier-free access for two sites designated by Parks Canada: the Georgian Bay Islands (Beausoleil Island and Honey Harbour) and the Trent-Severn Waterway (Port Severn and Big Chute). TDC contracted with TES Limited of Ottawa to develop the designs and perform the engineering work. The work resulted in unique fixed- and floating-dock designs. The project also adapted building code requirements for land-based facilities and developed a series of recommendations for water transportation at the study sites (Baertschi and Watson, 1994). Parks Canada implemented the design for an accessible dock at Georgian Bay Islands National Park in 1995.

Because the above national park sites can only be reached by water, the docking system must serve private and commercial vessels. The designs aimed to adapt accepted standards and solutions to the specific environment; to provide safe and convenient access from boat to land; to offer persons with disabilities choices in available dock height; and to minimize the cost, thus improving the chances of actual implementation. The basic structure of the dock is different for the two sites, although such general concepts as contrasting stripes, handrails, ramp slopes, and perimeter curbs were used in the same way in all situations.

The accessible dock at Beausoleil Island required a two-level floating dock design, because water levels fluctuate up to 2.5 m. The concept will allow the operator to easily add a third level in the future, if necessary.

The generic accessible dock concept developed for the lock stations of the Trent-Severn Waterway has a very compact design and offers boaters four different levels of access. Such variety is possible because the water-level fluctuations are very small, thus allowing Parks Canada to use fixed docks, which are more stable than floating docks. These generic docks can be used in most situations by tailoring site-specific access ramps from land to dock.

In 1995, the floating docking facility installed at Beausoleil Island in Georgian Bay Islands National Park was evaluated (Baertschi and Watson, 1995). This included an analysis of user concerns, operational concerns, and the actual functional requirements of the dock. Section 16.7 contains recommendations based on this evaluation.

16.7 Guidelines for Planners and Designers

The team that evaluated the level-change system developed for the Atlantic ferries made the following recommendations:

- See-through, solid folding doors or gates should be provided for subsequent level-change systems, if this type of system is installed.
- The ramp should be lighter or should operate automatically.
- The ramp slope should be decreased.
- Ongoing training of attendants should become a part of the regular ferry training program.
- Designers should ensure that the lift system can be maintained throughout the operating season and that it can be serviced at least once a year by a qualified lift-service technician.
- An oil-heater or similar device should be used in new systems to ensure consistent operation under low temperatures.

In addition, the following general recommendations were provided on the east coast ferry services:

- The ferry operator should coordinate all pre-embarkation, embarkation, and disembarkation information, as well as logistical activities.
- All federally subsidized ferries presently in service should be fitted with a level-change system.
- Other on-board accessibility features should be reviewed.
- The needs of persons with sensory disabilities should be reviewed.
- Overall, signage for accessible features should be reviewed/evaluated.

Table 16.1 summarizes the infrastructure and customer-service improvements that would help seniors and customers with disabilities.

The following recommendations are taken from the evaluation report on the floating docking facilities at Beausoleil Island:

- The gangway should be centred on the floating platform to provide sufficient space for a wheelchair manoeuvring between the edge of the dock and the gangway (the minimum turning radius for a wheelchair is 1.5 m).
- Overhanging grab bars would provide a secure handhold during embarkation and disembarkation.
- Warning stripes on the top surface of the dock must be readily distinguishable from the colour of the surrounding water.
- Vivid stripes of contrasting colour and textured material would help visually impaired users to detect changes in slope on the gangway and associated superstructure.
- Handrails and ramps should meet current CSA standards (see Table 3.2).

Service planners who require a fuller discussion of this topic should consult the following:

- Section 3.3 for pedestrian access, Section 3.4 for terminal facilities, and Section 3.5 for human factors in design;
- Section 5.2 for communications media and technology;
- Sections 6.3.6 and 6.4.4 for safety requirements;
- Chapter 7 for staff training programs;
- Section 17.2 for multimodal travel requirements;
- The applicable CTA guidelines;
- Canadian Standards Association CAN/CSA-B651-95 on *Barrier-Free Design*;
- Carriers that have developed specialized accessibility technology, including airlines, GO Transit, VIA Rail, the Greyhound Group of Companies, and the urban transit systems in major cities.

Table 16.1 Recommended infrastructure and customer-service improvements

Infrastructure Recommendations

Provide

- courtesy seating areas
- colour-contrasted markings on steps
- tactile maps
- increased lighting in areas where signage is provided
- tactile information cues
- grab bars and handrails
- tactile markings
- call buttons
- information cassettes
- video monitors
- captioning on video monitors
- a TTY/TDD installation
- flashing lights at key locations, including washrooms, during emergencies

Improve

- pedestrian access to all facilities
- visual maps
- signage to conform with human-factors principles
- door-opening mechanisms

Redesign

- uniforms of crew members to make them more visible
- cafeteria menus
- life jackets

Consider

- an FM loop communications system

Customer-Service Recommendations

Provide

- information brochures in alternative formats
- pre-embarkation assistance

Improve

- queuing procedures
- public announcements
- sensitivity training for crews

– 17 –

MODAL INTEGRATION

– 1 – Introduction

Customer Access

– 2 – Trip Planning	– 3 – Roadways & Terminals	– 4 – Personal Vehicles

System Accessibility

– 5 – Communications Systems	– 6 – Safety & Reliability	– 7 – Training	– 8 – Research & Development

Public Carriers: Local

– 9 – Accessible Taxis	– 10 – Urban Bus Systems	– 11 – Urban Rail Systems	– 12 – Rural Systems

Public Carriers: Intercity

– 13 – Air Transport Systems	– 14 – Intercity Rail Systems	– 15 – Intercity Bus Systems	– 16 – Marine Systems

– 17 – Modal Integration

17 Modal Integration

All trips begin and end in the pedestrian mode. Therefore even very short trips on public carriers involve at least two modes. Regional intercity trips may involve several mode changes. For example, a trip between Nanaimo and Vancouver, B.C., could involve private vehicles, taxis, paratransit feeder buses, two ferries, transit buses, and an urban rail system.

Trips across Canada may be further complicated by requiring transfers between carriers of the same mode and stopovers, as well as modal changes. For example, a bus trip from St. John's, Newfoundland, to Victoria, B.C., would involve seven different bus companies and two ferries. A similar trip by air would require two or more changes of aircraft. A trip by rail would be equally complex, involving bus systems at both ends and overnight accommodation. This need for modal transfers and stopovers adds to the cost of travel.

For a traveller with a disability, the success of a trip depends on how easy it is to change modes and carriers. Any breakdown or deficiency in one of the trip links could ruin a trip for such a person. To overcome these problems, good customer communications are essential, not only to make the interfaces work, but also to reassure passengers that the carriers are aware of them and their needs. In addition, the institutional constraints of the different carriers must be harmonized so that common rules and regulations apply and passengers are not penalized by jurisdictional disputes.

The terminal systems for providing information and communicating with customers may also be troublesome. For persons with cognitive disabilities, the local communications systems are critical to a successful trip. For persons with visual and hearing disabilities, alternative information systems (print or tactile; voice or visual display; flashing lights or vibration) allow the traveller greater independence. Communication systems are discussed in Chapter 5.

17.1 Consumer Perspectives

Table 17.1 provides an overview of accessible transportation in Canada in 1996.

From the customer's perspective, public carriers must meet the following conditions in daylight and darkness, as well as in all weather:

- available
- safe
- comfortable
- convenient
- reliable

Table 17.1 Accessible transportation in Canada – a 1996 overview

Pedestrian Trips	Most urban areas are reasonably accessible. Trips are often more circuitous than necessary. Signs, traffic signals, crosswalks, and access from parking areas may be troublesome. Wayfinding systems are needed.
Automobile Travel	Most four-door vehicles can be adapted for drivers with disabilities. Cost is a barrier for many. Evaluation of the capabilities of disabled drivers is improving in major cities.
Accessible Taxis	Demonstration projects and financial incentives have not resulted in widespread deployment. Vancouver is the only city with a large accessible taxi fleet. Subsidies have been used as an incentive. The capital cost of accessible vehicles is a major barrier for taxi operators.
Urban Bus	Most communities have paratransit service. Transit systems are purchasing low-floor buses. Most urban bus systems will be accessible by the year 2005. Intelligent communications and fare-collection systems are being used.
Urban Rail	Vancouver, Calgary, and Edmonton have accessible rail systems. Portions of the subway system in Toronto are accessible. A visual communications network has been installed in the Montreal subway. Most systems are improving customer wayfinding.
Rural Systems	Most communities have paratransit service. Funding varies considerably and is uncertain in some regions. Many areas rely on volunteers.
Air Transport	Large aircraft and terminal facilities in major cities are accessible. Communications systems are being improved. Service is less accessible when using smaller aircraft, and in smaller communities.
Commuter Rail	The GO Transit rail system became accessible at major stations in 1995. A new commuter rail system in Vancouver is accessible. Two stations on the Deux-Montagnes route in Montreal are accessible.
VIA Rail	The LRC cars used by VIA Rail are accessible. A total of 48 VIA stations out of 500 are accessible.
Intercity Bus	Accessible buses are being operated in regular service by several major carriers. Reservations are required. Substantial improvements are needed in customer communications systems and in bus technology.

Table 17.1 Accessible transportation in Canada – a 1996 overview *(cont'd)*

Ferry Services	The major coastal ferries are accessible, as is SeaBus in Vancouver. The availability and accessibility of feeder systems is uncertain at most terminals.
Trip Planning	Several carriers, including Air Canada, GO Transit, and VIA Rail Canada Inc., have introduced detailed guide books. Customer tracking systems are becoming more common.
Communications Systems	Technology tends to be developed for one mode only. Greater transfer between modes is desirable. Sign technology is improving, but a great deal of implementation work remains to be done. Multimedia, including tactile, print, audio, and video, are needed.
Safety and Reliability	Security for seniors on urban transit systems needs more attention. Travel by bus is less secure at night. Reliability in rural areas is uncertain.
Training	Awareness of the needs of seniors and persons with disabilities is improving. More consistent guidelines by professional educators are needed.

A prospective customer assesses the travel options and chooses the most suitable mode or modes based on available advice and previous travel experience.

Travellers with disabilities, like all travellers, want to be able to choose: first, among the modes of travel available; and second, among the service options available. This is the essence of travel with dignity and self-determination.

For a traveller with a disability, often only one mode is available. If that one mode is temporarily out of service due to maintenance problems or climatic conditions, the consequences can be serious.

Travel on major carriers usually involves stress caused by the physical exertion and anxiety. Designers of new air terminals are attempting to reduce the long walks from parking areas to boarding areas by placing these facilities in closer proximity. New information and communications systems are being developed in an attempt to provide reassurance and to reduce anxiety.

One aspect of travel often overlooked by planners and designers is the problem of maintaining access during periods of reconstruction. From the perspective of customers, some air terminals seem to be under continuous reconstruction. The relocation of familiar environmental cues can be very stressful for some travellers with disabilities. For others, who carefully plan their restroom and meal stops, the relocation of facilities to another area in a terminal can upset their travel schedule.

The reliability of pedestrian and urban bus modes in winter and the practicality of linking such trips depend greatly on municipal snow removal on sidewalks and at bus stops. In many cities, the transit-operating authority has an agreement with the public works department to ensure that snow removal at accessible transit facilities is given a high priority. Similar treatment is required wherever inclement weather conditions impair pedestrian access.

17.2 Trip Links

Figures 17.1 and 17.2 show the complexity of trip links. As noted previously, intercity trips can be exceedingly complex, requiring several mode changes. The mode changes may involve many level changes, which are potential barriers to travel. The ability to go directly from origin to destination (often from accessible door to accessible door) by paratransit explains why many travellers prefer this mode.

In an ideal world, all links in the transportation system, from trip planning through pedestrian movements, terminal access, boarding, deboarding, and the interfaces between modes, would be harmonized and fully accessible. This ideal is becoming known among transportation planners as the “seamless trip”. Such a world is anticipated in the Transportation Association of Canada’s *New Visions in Urban Transportation* (TAC, 1994). TAC suggests that by the year 2023 it will be possible to achieve universal access for physically disabled travellers. With the exception of intercity buses and the interfaces between modes, some communities are already close to achieving *universal physical accessibility* in urban areas. In future, the major challenge will be to develop technology that will ensure access to persons with less visible disabilities, including cognitive disabilities, and to make travel more comfortable and convenient for all.

The importance of trip links is illustrated by a review of the use of taxis in Montreal (Trudel, 1992):

- 30 percent of taxi passengers made urban transit connections
- 12 percent of taxi passengers used private vehicles for part of their trip
- 9 percent connected to airlines
- 4 percent connected to intercity buses
- 2 percent connected to intercity rail systems

“Transit Technologies for Everyone: Visions for Future Transit” suggests ways in which universal access may be delivered in the future (Geehan, 1995c). This presentation was developed for transit, but the ideas could apply to any mode. The components of universal access envisioned include:

- transportation planning information via the cable network in audio, video, and large-print systems;

- keyless home-security systems;
- updated schedule information at wayside terminal waiting areas, for reassurance;
- fully accessible, low-floor vehicles with optional rear-facing seating;
- audible and visual vehicle identification;
- universal electronic fare-collection systems using hands-free proximity cards;
- fully integrated, multimodal transportation terminals with sufficient accessible parking;
- protected wheelchair positions on rail and bus systems;
- interactive personal mobility devices using cellular telephone, visual display, electronic communications, and global positioning technology;
- electronic crosswalk safety systems that reduce conflicts between vehicles and pedestrians;
- audible, tactile, and electronic cues for wayfinding in terminals;
- communications systems that track the customer and assure that priority seating and special services are available.

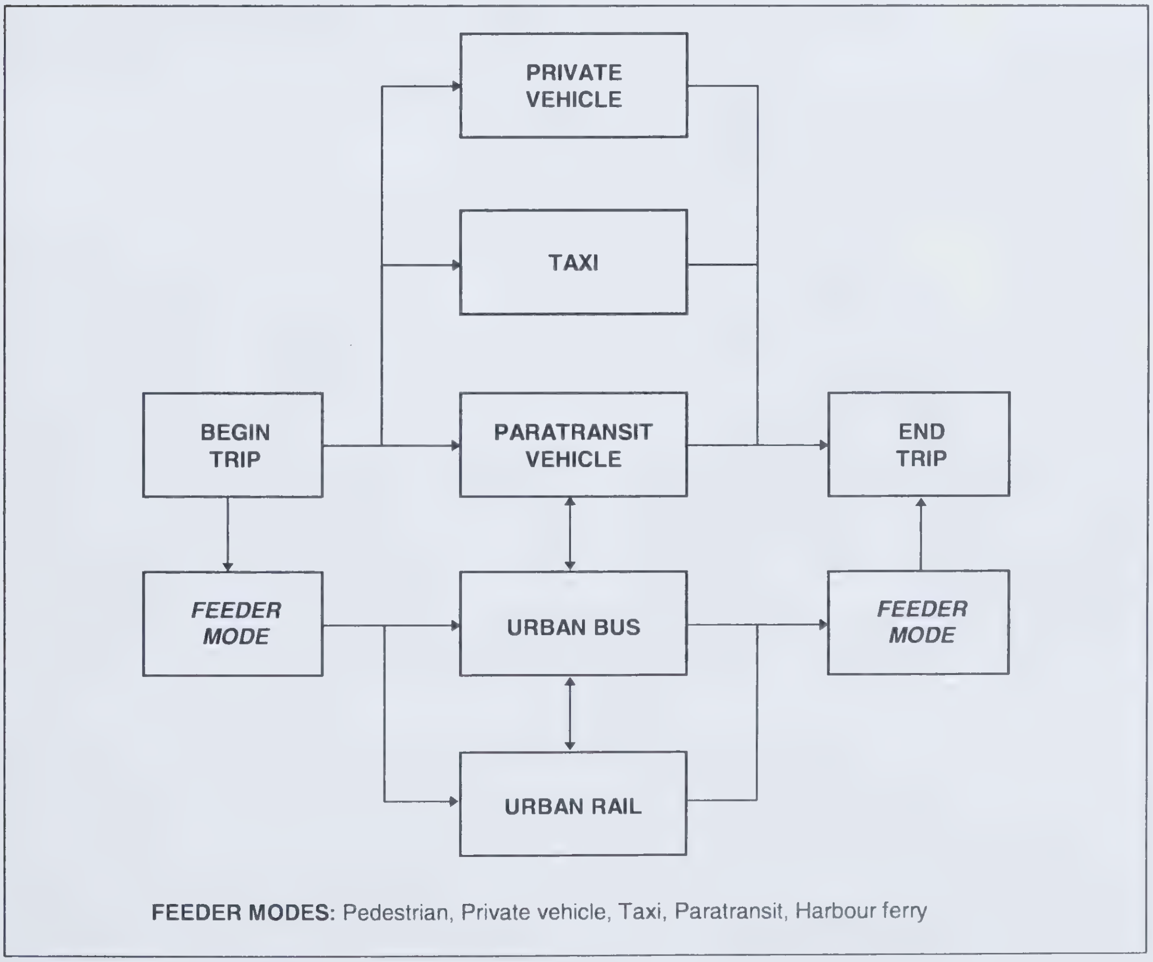


Figure 17.1 Typical modal links: Urban trip

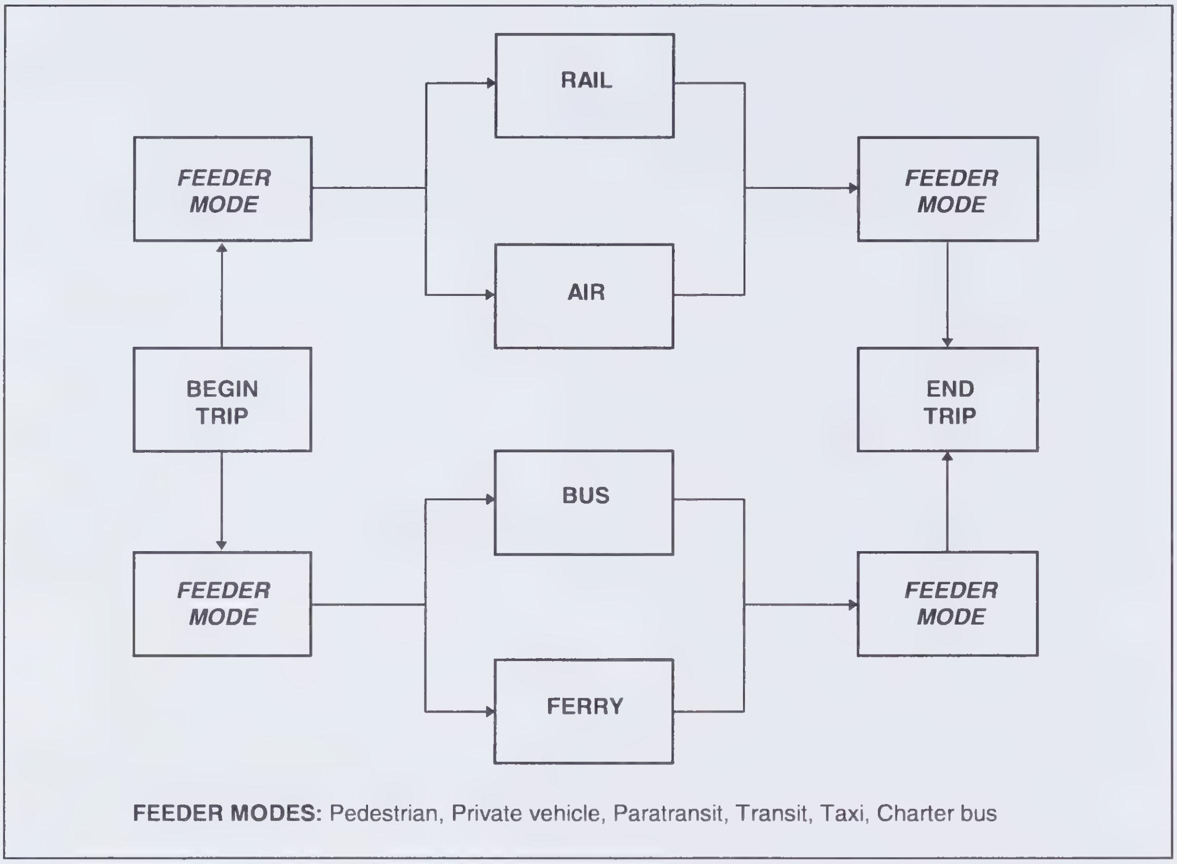


Figure 17.2 Typical modal links: Intercity trip by public carrier

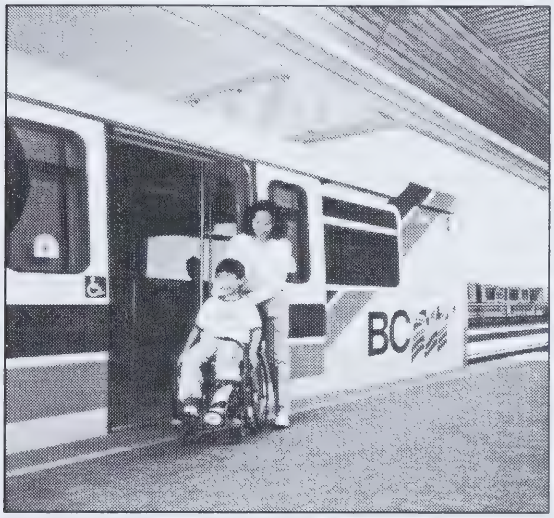
17.3 A Case Study in Delivering Accessibility

Vancouver was the first city in Canada to undertake to achieve full transit accessibility within an urban region (see Figure 17.3). This was largely because of the efforts of consumer advocates and the willingness of local municipal and provincial policy makers to innovate.

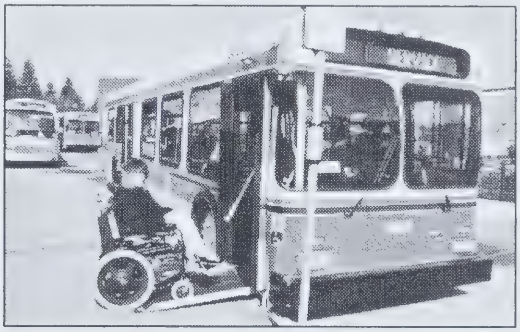
Vancouver's accessible transportation system resulted from the following:

- an extensive redesign of curb cuts for wheelchairs, beginning in the 1970s;
- amendments to the Vancouver taxi licensing by-law in 1980 to provide an incentive for accessible taxis;
- BC Transit's integration and deployment of paratransit services for persons with disabilities in 1980;
- a decision in 1984 by BC Transit to make the Light Rail Transit System (SkyTrain) accessible;
- the management of accessible parking permits by the Social Planning and Review Council (SPARC);
- the installation of an elevator in the SeaBus terminal in 1986;

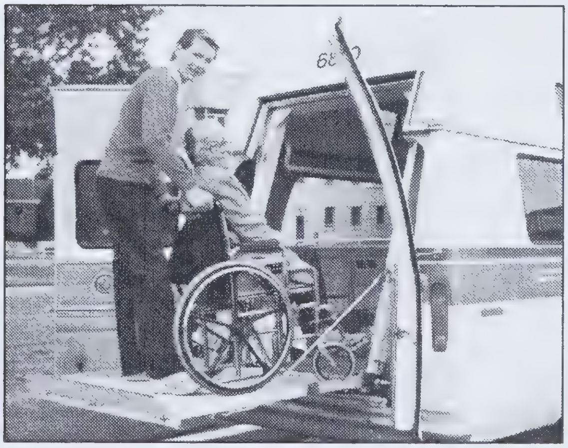
- a decision in 1989 by BC Transit to make the transit buses and trolley coaches fully accessible by the year 2006;
- a decision in 1994 by BC Transit to make the new commuter rail system fully accessible.



Sky Train



Accessible Bus



handyDART

SeaBus

Figure 17.3 Integration of accessible transit in Vancouver
(BC Transit)

BC Transit is a provincial Crown corporation with a mandate to plan, administer, operate, and fund urban transit services in communities throughout British Columbia. The Vancouver region includes 20 municipalities and is the largest

urban community in British Columbia. Its transit service area is the largest in Canada, with a large proportion of seniors and persons with disabilities in the population (Chown, 1992).

The regional transit system operates diesel buses and trolley coaches, SkyTrain, and SeaBus. SkyTrain is a 28.5 km automated, grade-separated, light rapid transit line extending southeast from central Vancouver to Surrey. SeaBus is a 400-passenger catamaran ferry that traverses Burrard Inlet between Vancouver and North Vancouver. In addition, handyDART, a paratransit service for people with disabilities, is operated under contract by eight local community organizations.

Partly as a result of intensive lobbying by the Committee to Promote Accessible Conventional Transit (COMPACT), the Board of Directors of BC Transit became concerned about the provision of transit services for persons with disabilities, and the policies governing these services. In 1988, the Board appointed a three-person task force under the chairmanship of the mayor of Vancouver to examine and report on transit services for persons with disabilities.

The feasibility of introducing lift-equipped buses in the Vancouver region was one of the task force's major interests. A staff report, *Proposed Implementation Strategy for Lift-Equipped Buses in the Vancouver Region*, examined this concept and concluded that a 17-year implementation period would be needed to make the regional bus fleet fully accessible. A second staff report, *Custom Transit Policy Review*, examined and compared several options for improving transit services: accessible buses, enhanced handyDART service, a taxi scrip program, and a community bus service. Both of these reports were widely distributed to individuals and organizations representing persons with disabilities (BC Transit, 1989; Leicester, 1992).

Following a series of public meetings and a review of all submissions, the task force submitted its recommendations to the Board of Directors. The Board subsequently adopted the following policy in mid 1989:

> BC Transit's Policy will be to provide a framework for transit commissions and municipalities enabling them to offer integrated multimodal transit systems for persons with disabilities. To that end BC Transit will:
>
> - Acquire conventional transit vehicles with features which enhance their accessibility. All vehicles will be constructed such that they may be made wheelchair accessible.
> - Develop training programs for operators of transit services to enhance their ability to deal with the needs of passengers with disabilities.

- Based on the request of a transit commission or local municipality, BC Transit will plan and fund handyDART services, taxi supplement, taxi scrip, and accessible fixed-route services.
- Based on the request of a transit commission or municipality and a mutually acceptable implementation plan, BC Transit will acquire conventional transit vehicles which are wheelchair accessible.

These activities will be carried out in accordance with the cost-sharing regulations of the *BC Transit Act* and the budget authority approved annually by the Provincial Government.

As soon as this policy was adopted by the Board, the Vancouver Regional Transit Commission recommended proceeding with an accessible bus program and, since an implementation plan had already been prepared, the Board agreed. The first 86 lift-equipped buses went into service on 22 routes in the Vancouver region in September 1990. The suggested taxi scrip program was also endorsed as an innovative concept to give people with disabilities more opportunities to make spontaneous trips. Subsequently, a taxi scrip program named *Taxi Saver* was introduced in 1991.

All 20 taxi companies in the Vancouver region participate in the *Taxi Saver* scrip program; together they operate about 1,000 taxis, of which 70 are wheelchair accessible. In 1986, the accessible taxis undertook more than 1,500 passenger trips per month for customers who use wheelchairs, and more than 10,000 trips per month for all customers with disabilities. On a passenger-trip basis, the average cost is approximately one-half the cost of a handyDART trip. The subsidy is 50 percent per taxi trip instead of the 90 percent for handyDART. *Taxi Saver* participants are particularly pleased with the program because it allows them immediate access to the taxi service of their choice at any time of the day or night.

Experience in Vancouver indicates that there is not necessarily one ideal method of providing transit service for all persons with disabilities. It also demonstrates a need, once a program is decided upon, for all participants to work towards a common goal: political representatives must provide continued funding support; transit staff must be committed to the program's success and must ensure that it is implemented and operated for the benefit of customers; and persons with disabilities who expect to be transit passengers must be fully involved in program planning from the outset, as they provide some of the most important input.

17.4 Guidelines for Planners and Designers

Advice and assistance in integrating of accessible transportation systems is available from many sources:

- The Canadian Standards Association;
- The Canadian General Standards Board;
- The Canadian Transportation Agency;
- Research agencies such as the Transportation Development Centre;
- Federal, provincial, territorial, and municipal government organizations;
- Consultants in design, ergonomics, urban planning, transportation architecture and engineering, and communications technology;
- Consumers and consumer associations that have been involved in the planning, design, and monitoring of projects;
- Transportation associations (see Section 1.7).

Combinations of many practices and technologies are needed to make transportation systems fully accessible for everyone:

- Adequate communications systems (see Chapter 5);
- Accessible pedestrian ways (see Section 3.3);
- Safe environments (see Section 6.3);
- Accessible terminal facilities (see Section 3.4);
- Fully accessible vehicles (see modal chapters);
- Adequate training programs (see Section 7.7).

The following sections provide a process for evaluating facilities and services.

17.4.1 Review the Information/Communications Systems

Those responsible for evaluating the accessibility of a transportation system should first examine the printed media, including timetables, brochures, maps, signs, and advertisements in magazines and newspapers (see Section 2.4).

- Is the language used easy to understand? Does it avoid carrier jargon?
- Do the graphics support the message?
- Is the type size large enough?
- Is colour coding kept to a minimum?
- Is the information adequate for the customers? (Does the service provide information on inter- and intra-modal links?)

Next assess the telephone communication systems:

- Are alternative forms of telecommunications (TTY/TDD) provided?
- Can prospective customers easily access the telephone system?

- Are there barriers to or delays in accessing the carrier's telephone information service? (Cost may be a barrier for some if 800 numbers are not provided.)
- Is the telephone response clear, concise, and in a language that is easily understood?
- Is the information service interactive? Is the option of two-way communication available?
- Are the carrier personnel polite, attentive, and helpful?
- Are any systems in place to identify a caller as a person with special needs?

17.4.2 Examine the Access Modes and Systems

Planners should make an inventory of all of the local transportation services and the numbers of accessible vehicles in their fleets. Identify any barriers to providing access links.

- Does the community provide a regular transit or paratransit link that uses accessible vehicles? Do the feeder schedules match the carrier's operating schedules and the days that service is offered? Are there any institutional barriers to service?
- If the community does not provide an accessible link to the carrier, are there any private companies or non-profit agencies that may be able to provide feeder services?
- Who regulates privately operated services? Are changes needed in the regulations to allow private companies to serve the terminal?
- Does the local taxi industry have any accessible vehicles? If not, can incentives be provided by the carrier to encourage the acquisition of accessible vehicles?

Review pedestrian and automobile access with local authorities responsible for traffic systems. (In very small communities and rural areas the local policing agency may be helpful.)

- Can persons who use mobility devices easily gain access to the carrier's terminal facilities? Are there any barriers that should be removed?
- Does the municipal traffic-control system provide for easy entry to and exit from the carrier's premises?
- Is the municipal traffic information signage adequate? Can the terminal be located easily?
- Do the local community maps provide adequate information? Do they need to be updated?

17.4.3 Review the Terminal Accessibility

Planners should review the external terminal infrastructure (see Section 3.3).

- Is the amount of accessible parking adequate? (Refer to Table 4.2)
- Do the pathways to the terminal meet CSA standards?
- Is the maintenance program adequate?
- Does the exterior lighting meet CSA standards?
- Is the directional signage adequate?
- Are the entrances easy to locate?
- Are there adequate parking and drop-off areas for the access modes?

Review the internal terminal facilities and communications systems. Use the checklist in Table 17.2, the information provided in Section 3.4 and Section 5.2.2, and the applicable modal chapter(s).

- Do the facilities meet all applicable CSA standards?
- Has provision been made for temporary facilities and adequate signing during periods of construction?

A design checklist for accessibility, covering most of the requirements, is presented in Table 17.2 (Smith, 1992b).

Table 17.2 Design checklist for transportation accessibility

	Vehicles	Terminals
Environment		
Sufficient, well-positioned lighting	✔	✔
Telephones and information kiosks not near or under sources of noise, including PA systems		✔
Adequate sound insulation	✔	✔
Clean environment	✔	✔
Adequate seating and seat design	✔	✔
Adequate accessible washroom facilities	✔	✔
Uncomplicated facilities (telephones, ticketing, and turnstiles that function simply, and demand little effort)	✔	✔
Visual and audible cues for stairs, doors, and windows	✔	✔
Sufficient handrails and grips	✔	✔

Table 17.2 Design checklist for transportation accessibility *(cont'd)*

	Vehicles	Terminals
Environment *(cont'd)*		
Non-slip surfaces	✔	✔
Adequate safety and security	✔	✔
Adequate maintenance of accessible technology and facilities	✔	✔
Accessible access ramps, doors, elevators		✔
Accessible vehicles (ramps, steps, swivel seating, securement systems)	✔	
Improved ride quality (suspension system)	✔	
Customer Communications		
Information in as many languages as possible	✔	✔
Sufficient and adequate signs (static and electronic) for instructions, location, direction, and procedures	✔	✔
Real-time information and communications	✔	✔
Adequate information on delays, difficulties, and emergencies	✔	✔
Simple, reliable communication devices, e.g., message cards	✔	✔
Accurate time reliably shown and visible at a variety of locations		✔
Print media and signs responsive to human factors	✔	✔
Headrest speakers and microphones, and other devices for driver-to-passenger communications	✔	
Operations		
Sufficient and adequately trained personnel	✔	✔
Simplified ticketing/payment systems	✔	✔
Suitable internal transportation for large terminals (intra-terminal travel and inter-terminal transfer)	✔	✔
Pedestrian flow designed to accommodate slower-moving, less able travellers	✔	✔
Segregation of noisy, boisterous groups	✔	✔

(Transportation Development Centre)

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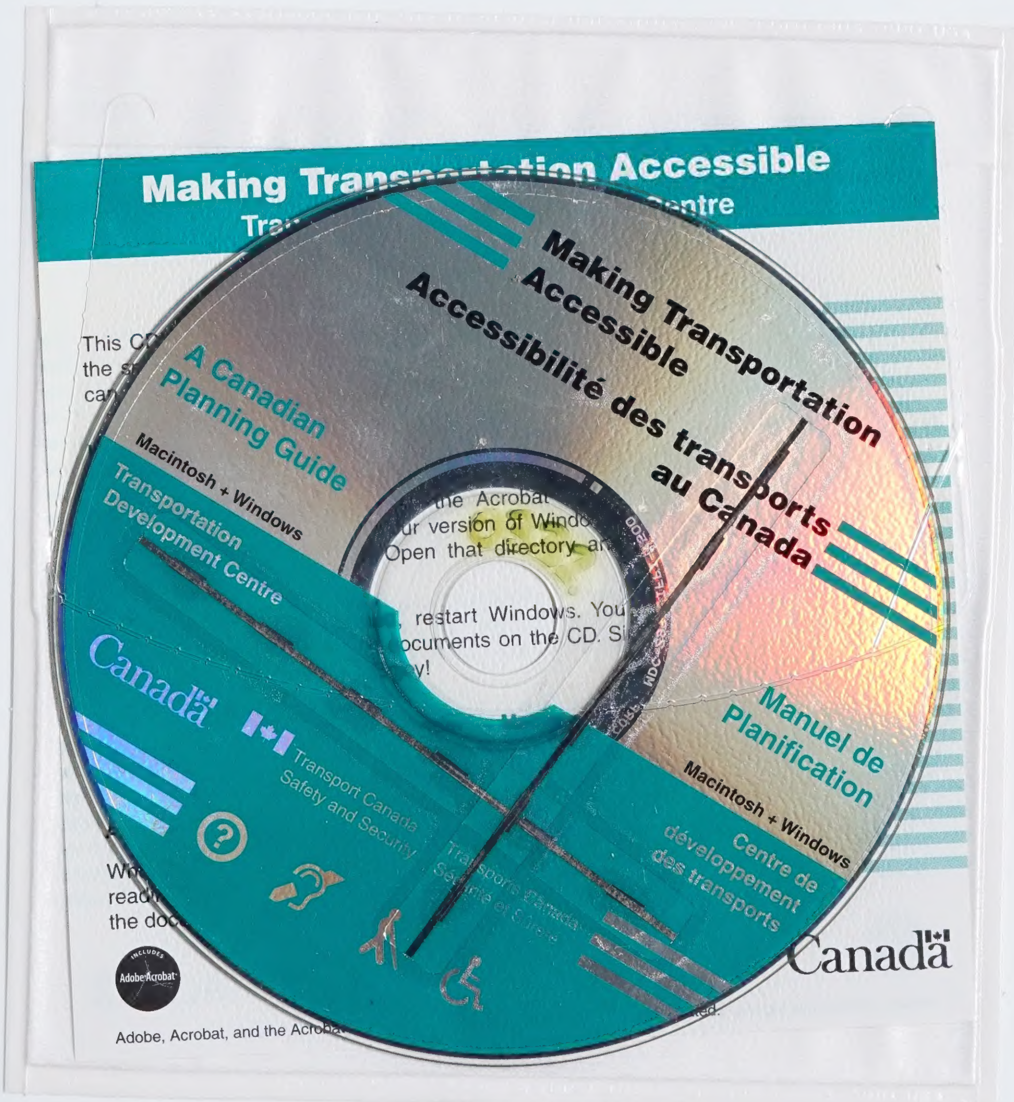

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